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PRINCIPLES AND PRACTICE

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MEDICINE.

BY

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MEDICINE.

HYPERÆMIA OF THE BRAIN AND ITS MEMBRANES.

Cerebral hyperæmia is frequently associated with congestion of the membranes of the brain, and with cerebral hæmorrhages. The condition often occurs in early infancy and childhood. It appears in two forms, active (fluxion) and passive (congestion), of which there are severe and mild varieties. The passive form is frequently seen in cases where there is some mechanical or other impediment to the return of blood from the brain. The most marked degree of the active form is called congestive apoplexy, and is due to overloading of the cerebral vessels from an increased flow of blood. This induces perversion or abolition of cerebral functions, as evidenced by headache, giddiness, delirium, coma, or convulsions.

Causes.—Active hyperæmia.—It results from increased heart-action, and may be due to a variety of causes. In children cerebral congestion frequently occurs during the course of an eruptive fever, but generally in a more marked degree at its commencement. It also occurs during dentition. Irritation of worms and various gastric disorders lead to it. In adults hyperæmia may be temporary, as in fevers, or after violent mental excitement or muscular efforts. It may also be habitual, as in cases of hypertrophied heart due to obstructive valvular disease. In albuminuria (morbus Brightii) hypertrophy of the heart frequently occurs, and hence cerebral hyperæmia is a symptom of that affection. Weakness of the coats of the cerebral vessels is another cause of hyperæmia. When it exists the vessels yield readily to the pressure of the blood, and if the heart's action be increased hyperæmia results. During the cold stage of intermittent fever the obstruction to the cutaneous circulation produces hyperæmia of the brain and other internal organs. Similar obstruction to the cutaneous circulation occurs in drunkards exposed to severe cold, and they also suffer from cerebral hyperæmia. Ardent spirits and various poisons have the effect of paralysing the cerebral vessels, which thus become dilated, and hyperæmia results. Other conditions are: general plethora, and all those causes the operation of which leads to increased flow of arterial blood into the brain, *e.g.* excessive mental labour, chorea, epilepsy, tetanus, and mania. In these conditions the cerebral arteries are full, while the veins are less distended.

Passive hyperæmia.—In children cerebral congestion often occurs during the progress of chronic bronchitis, hooping-cough, and in laryngismus stridulus. The same condition is also noticed in cachectic children suffering from enlargement of the liver and spleen, and from various other diseases which lead to impeded flow of blood from the brain. In chest diseases, during coughing there are violent expiratory efforts, while the glottis is contracted, the flow of blood into the chest is obstructed, and cerebral congestion is produced. In adults hyperæmia is sometimes due to compression of the jugular veins by enlarged glands, and of the vena cava superior by aneurysms or other tumours. Valvular disease of either side of the heart leads to congestion of the brain; in disease of the right side the effect is very marked. Emphysema in its last stages gives rise to cerebral congestion of a very profound character.

Post-mortem appearances.—It is often difficult to determine whether the vessels of the brain are unduly congested or only normally full. In the severe (active) form the small blood-vessels, and also the capillaries of the brain, are increased in size, and the latter appear injected. The congestion is out of proportion to the amount of blood in other organs. The pia mater has a rose-coloured appearance, in patches or throughout its whole extent. On section of the brain, blood oozes out in large drops, the grey matter is reddened, the choroid plexuses are dilated, and the sinuses contain an excess of fluid. In the passive form the cerebral veins are distended with dark-coloured blood; the brain is of a pale colour, and on section presents a few small bloody points. These appearances cannot be relied on long after death.

Symptoms—Although in every case of congestion of the brain there is more or less derangement of cerebral functions, it must not be assumed that the latter is always associated with and dependent upon the former condition. The disturbance which often exists in fevers is due to the high temperature of the blood, and to the changes in its quality, the results of the increased metamorphosis of tissue. Similar disturbances also exist in cases of acute alcoholic as well as narcotic poisoning, and the symptoms are not dependent upon hyperæmia alone. In the severe form of cerebral hyperæmia the symptoms vary greatly. In some cases there may be a mere sense of giddiness, headache, and undue sensitiveness to external impressions. It is to be remarked that this condition is undistinguishable at its commencement from some forms of apoplexy. Such symptoms have sometimes been spoken of as warnings of apoplexy, and it is a fact that after several such attacks true apoplexy does often occur. In most cases the symptoms are those of nervous excitability and disturbance of mental action. Both the motor and sensory functions are deranged, the derangement varying with the seat of hyperæmia. The onset may be sudden or gradual. There may be general uneasiness and restlessness for a few days, during which the patient may complain of slight fever, pain in the head, giddiness, and constipated bowels. When the disease commences suddenly, and in a child, the patient awakes from sleep, complaining of a severe pain in the head, the eyes are red, and there is often vomiting. In plethoric adults fulness of the cerebral vessels is of common occurrence. As a general rule the symptoms of the grave and of the mild form of cerebral hyperæmia closely resemble each other, and occur in various combinations. In both there is lack of normal supply of blood, and the healthy performance of functions is interfered with. The symptoms are those of irritation or increased excitability of nerve filaments and ganglionic cells, or of depression or diminished excitability. Usually the symptoms of irritation are prominent at first, and are subsequently followed by those of depression. In many cases, however, and especially among the natives of India, symptoms of depression set in from the beginning. The symptoms of increased excitability are due to the pressure of the distended vessels on the brain, the effect being communicated to the peripheral nerves. Where the pressure is moderate the effect on the nerves is that of irritation; when severe the nerves become paralysed.

(1) The symptoms of *irritation* are manifested by derangements of the sensory and motor functions, and by various mental disorders.

Sensory disorders.—These are—(*a*) headache, (*b*) derangement of special senses, and (*c*) extreme sensitiveness to external impressions.

(*a*) *Headache.*—In the mildest form the congestion is only temporary, as occurs, for example, in spasmodic cough, and the symptoms are those of pressure in the head. In more severe cases the face is livid and puffy-looking. There is slight throbbing of the carotids and constant dull headache or uneasiness in the head, confined chiefly to the vertex or behind the ears. Vertigo or dizziness and faintness are frequent accompaniments, and the patients sometimes complain that all surrounding objects appear to be in motion. There may be delirium resembling chronic alcoholism.

(*b*) *Derangement of special sensation.*—The patient often sees objects or hears voices which have no existence. There is confusion of mind, impaired memory, indisposition to work, irritability of temper, sleeplessness, or unrefreshing sleep, often disturbed by vivid dreams.

(c) *Extreme sensitiveness to external impressions.*—This is evinced by intolerance of light, which, however, soon passes into dimness. The sense of touch is inordinately excited, and there are sensations of formication or undefined pain.

The *symptoms of motor disturbance* are shown by sudden starting and grinding of the teeth, or even by convulsions.

(2) *Symptoms of depression.*—These arise in cases where there is passive hyperæmia, or obstruction to the escape of venous blood. The supply of oxygenated or arterial blood is limited. These symptoms, like those of irritation, relate to psychical disorders and to motor and sensory derangements.

Psychical.—These are drowsiness, often amounting to a state of unconsciousness; apathy or indifference; some confusion of ideas, but with mental torpor instead of irritability. The derangements of special senses are shown by insensitiveness to light and sound, and to external impressions. The *motor* symptoms consist of complete inability for voluntary movements. The insensibility may be partial or complete; it is generally of short duration. The face is flushed; there is throbbing of the carotids and heat of the head. In hyperæmia of the brain there is derangement of those involuntary movements which are under the influence of the cerebral nerves. Thus, the pupils are contracted in the early stage or during irritation; they become dilated during depression, and regain their natural size when the hyperæmia subsides. The contraction is due to excited action of the motor oculi nerves; the dilatation is due to the action of the sympathetic. During cerebral depression the respirations are very slow, deep, and stertorous. The pulse is slow and often full during depression, and frequent and quick when the symptoms are those of excitement.

Diagnosis.—Cerebral hyperæmia is often mistaken for meningitis in children. In both conditions the motor disturbances are well marked. In hyperæmia there is generally a previous history of constipation and of fretfulness, restlessness, and disturbed sleep. The child often gnashes its teeth during sleep. There is also vomiting, with twitching of the limbs and contraction of the pupils. The head is hot and the face flushed. These symptoms are followed by convulsions, which may pass into stupor. Between the attacks of convulsions the patients are often bathed in sweat, and lie in an apathetic state. The breathing is labouring and the mouth full of saliva. The abdomen is swollen. Such attacks may end in a few minutes, or may last for several hours. In this disease recovery follows as a rule. The condition is often the precursor of an eruptive fever. In meningitis (tubercular) convulsions are not an early symptom. The affection occurs in weakly children, who generally exhibit other manifestations of a tubercular diathesis, such as glandular enlargements, &c.

Termination.—In the simple form the patient may return to his usual health in a few hours or a few days, but generally a condition of more or less imperfect health remains for some time. Congestion at the onset of an eruptive fever is sometimes very serious, and the patient may die within twenty-four hours.

Treatment.—The utmost coolness and decision are necessary on the part of the physician in treating a case of this disease. He must endeavour to trace out the cause, and to remove it. In children, if the gums are tender they should be freely lanced. If the complaint be due to undigested food or loading of the intestinal canal, an emetic, or a dose of calomel and jalap, will in all probability suffice for its relief. The patient should be kept in the horizontal position, and all mental exertion should be avoided. The principal means for the relief of the symptoms are leeches, cold to the head, and free action of the skin, kidneys, and bowels. These measures should not be used indiscreetly. In cases of active congestion venesection is highly useful. Leeches may also be applied to the temples or behind the ears, the object being to draw blood away from the head. Sinapisms applied to the calves or to the chest, or warm foot-baths, will give relief in cases where the carotids throb violently and the eyes are injected, and the patient suffers from headache. For constipation, croton oil or enemata of castor oil and turpentine may be given with benefit. In mild cases, aloes or jalap or calomel and colocynth will suffice. At the same time ice or cold affusions should be applied to the head. Sometimes liquor epispasticus, applied behind the ears or to the back of neck, will relieve the symptoms. Stimulants are to be avoided. Aconite, in small and repeated doses, may be given from the first, and if there is high temperature, with burning skin, great thirst, and hurried breathing, it is likely to be of great service. To relieve restlessness and to procure sleep, bromide of potassium, or hydrate of chloral with tincture of hyoscyamus, may be given. The patient should be kept in a cool, well-ventilated room, which should be darkened by curtains over the windows. The utmost quietness should be enforced. In cases due to passive congestion the cause must be first discovered and dealt with. If due to abuse of alcohol or narcotics, depletion and other antiphlogistic measures are extremely hurtful. They would only increase the weakness, and lead to death by asthenia.

In these cases ice to the head and derivatives are required. Foot-baths are serviceable. If the congestion be due to bronchitis or to spasmodic cough, the treatment must be directed towards the cure of the primary affection.

Sometimes repeated counter-irritation, as by small blisters behind the ears, is of immense service. In chronic cases benefit is likely to be derived from issues or setons in the arm or neck. In children tepid baths to the whole body, with cold affusion to the head, are often a good remedy. In every case the diet must be well regulated. It should be of a liquid character; milk is especially suitable. As a rule, in the case of children, beef tea and mutton broth do not agree, and must be avoided, as they increase any existing diarrhœa. In the case of adults, in whom the hyperæmia is due to plethora, antiphlogistics, purgatives, and light diet, without stimulants, may prevent an attack of apoplexy.

ANÆMIA OF THE BRAIN AND ITS MEMBRANES.

In this condition the entire amount of blood in the brain is diminished. It occurs in two forms, general and partial. General anæmia of the brain occurs in persons suffering from repeated attacks of hæmorrhage and from other exhausting discharges, as continued diarrhœa, &c. Anæmia of the brain is also found in cases of tedious and protracted fevers, where the waste of tissue is considerable, and reparative power is in abeyance. Owing likewise to an insufficient supply of nourishment, the new formation of blood is very imperfect, and anæmia is induced. Attacks of faintness, especially on assuming the erect position, are frequent in these patients, and are due to weak action of the heart and poor state of the blood. The brain is thus insufficiently supplied with blood. Partial anæmia, or partial diminution in the quantity of blood sent to the brain, occurs in cases where the carotids or the vertebral arteries are compressed by tumours or closed by emboli. The same result follows whenever there is any exudation (as in hydrocephalus), growth (hæmatoma or any other tumour), or extravasation (apoplectic clot) within the skull. In these cases collateral œdema exists in a certain space around the diseased portion. Anæmia also occurs in valvular obstructive cardiac diseases, with defective compensation; the integrity of the circulation and distribution of blood to the brain is disturbed in the course of these disorders. The veins are overloaded, while the arteries contain less than the normal quantity of blood, the circulation of which is much retarded.

Morbid appearances.—Very little change may be noticed within minutes, or may last for several hours. In this disease recovery follows as a rule. The condition is often the precursor of an eruptive fever. In meningitis (tubercular) convulsions are not an early symptom. The affection occurs in weakly children, who generally exhibit other manifestations of a tubercular diathesis, such as glandular enlargements, &c.

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of the limbs, or even convulsions. In a short time the patient is bathed in a profuse perspiration; the pupils are dilated, and the respiration is slow and oppressed. Where cerebral anæmia is the result of slow processes, such as prolonged hæmorrhages or discharges, we find at first symptoms of cerebral irritation, which sooner or later merge into those of depression. The most marked symptoms are those of disordered sensibility. There is severe headache, either in the forehead or the occiput, intolerance of light, with flashes before the eyes; a sense of dizziness, with noises in the ears. In anæmia of the brain in children, the symptoms resemble those of acute hydrocephalus. In the early stage the child is restless and irritable, tosses about in bed, grinds its teeth, and cries out in its sleep. The limbs twitch or there are convulsions; the face is flushed, the pupils are contracted; the child cries on being touched. The temperature may be 102° or 103°. In advanced cases the restlessness is followed by drowsiness, from which the child is roused with difficulty. The face becomes pale and cool, and the pupils insensible to light. The child lies with its eyes half closed. Such cases end fatally unless promptly treated.

In cases of partial anæmia affecting one portion of the brain, the symptoms are of a more local character. These are, headache limited to one side or one spot, sparks or flashes before one eye, contraction of one pupil, deafness of one ear, twitchings, spasms, or paralysis of one side, or of certain portions of the body. Symptoms of partial anæmia are often due to embolism or thrombosis, both which conditions frequently occur in the cerebral vessels. Thrombosis of the arteries of the brain is generally due to the condition known as atheroma, which results from chronic arteritis. In this process, portions of the lining membrane of the vessel eventually become detached, and calcareous deposits take place, the roughened surfaces of which lead to the formation of thrombi. Atheroma occurs chiefly in old age and in debilitated subjects. In such cases the radial and the temporal arteries are often found to be hard, tortuous, and rigid, owing to calcareous deposits. The cerebral vessels, when similarly affected, admit less blood, and finally become impervious or obstructed by thrombi.

Thrombosis most commonly occurs in the arteries supplying the great hemispheres and the large ganglia. As a consequence of syphilitic disease of the vessels it occurs in middle life. The changes which result from obstruction to the cerebral arteries are limited to the part of the brain which the obstructed vessel supplies. There are some parts of the brain—as, for example, the medullary masses of the hemispheres—which may be destroyed without any obvious loss of functions; that is to say, the lesions are unattended by any symptoms of paralysis. The symptoms of thrombosis dependent upon atheromatous degeneration come on gradually and slowly. In this degeneration there is dilatation of the larger vessels and contraction of the small ones. There are always some premonitory symptoms indicative of deranged circulation in the brain. The patient complains of headache, giddiness, noises in the ears, flashes of light before the eyes, and loss of mental power. Such patients are often apathetic and restless, or inclined to sleep. In thrombosis, as a general rule, obstruction takes place in small cerebral arteries, and hence it happens that the symptoms may readily be improved or removed when the supply of blood through the neighbouring vessels is increased. Very often the results of thrombosis extend to the optic thalamus and corpus striatum, and hemiplegia follows.

Partial anæmia of the brain may be due to cerebral embolism. An embolus is a solid substance carried away by the blood from the seat of its formation, and lodged in a distant vessel. Embolism of the cerebral arteries is due to valvular disease of the heart, to endocarditis, or to severe destructive lung-disease. The detached portions may be actual fragments of thrombi or of atheromatous plates. The most frequent seat of embolism is the middle cerebral artery of the left side. Its closure produces anæmia of the parts which it supplies. This is followed by softening, œdema, and subsequent degeneration. There is determination of blood in the surrounding adjacent capillaries, which may become ruptured, and give rise to hæmorrhage. The effects may disappear in course of time in young persons, whose vessels are healthy. The symptoms have a general resemblance to those caused by hæmorrhage, and the loss of consciousness is quite as complete if a large vessel be occluded. The symptoms of obstruction or occlusion then set in suddenly. The seizure may come on in an apparently healthy patient without warning, but it is almost always preceded by symptoms of the diseases to which the embolism is due. Thus, in every case of suspected cerebral embolism, the diagnosis depends upon the presence of either heart-disease, of endocarditis, or of lung-disease. Where a smaller vessel is involved there is at first anæmia of that part of the brain which the artery supplies. This is followed by hemiplegia, generally of the right side. It comes on in various ways—1. The patient while walking is attacked with a sudden vertigo and confusion of thought, and he falls forward to the ground. 2. Sometimes he awakes with a severe pain in the head and cries out; or, 3. He may suddenly faint and become convulsed. Sooner or later after these symptoms have passed away, more or less decided hemiplegia is observed to exist. The symptoms vary with the size of the vessel obstructed, and with the part of the brain to which the obstructed vessel is distributed—that is, according as the anæmia is in one of the large hemispheres or is below the tentorium. In anæmia, due to pressure affecting one of the great hemispheres, there is always hemiplegia affecting the lower half of the face, and both the upper and lower limb of the opposite side. In anæmia affecting the left frontal lobe there is aphasia—and this sometimes occurs when the lesion is on the right side,owing to the pressure on one side being readily propagated to the other. In affections limited to the parts of the brain in the posterior cranial fossa there is a combination of symptoms for the most part constant and characteristic. This is accounted for by the fact that the resistance offered by the tentorium to pressure acting on it is greater than that of the falx cerebri. The symptoms of anæmia of this part of the brain are vertigo, pains in the back of the head, vomiting, rigidity of the limbs, and partial loss of control over the bladder and rectum, and an effort at drinking is attended with choking. There is diminution of the sensory and motor powers, but no complete paralysis. The dizziness is peculiar; it comes on when the patient is moving about, but is not experienced when he is sitting or lying down. The difficulty of speech is peculiar. There is no want of thought, or of words to express ideas, but the motor power which is necessary for distinct and connected articulation is defective. All these symptoms of occlusion have a general resemblance to those caused by hæmorrhage or small extravasations. Where a large cerebral artery or several arteries are closed gradually by thrombosis, each attack adds its own special symptoms to those which have been already exhibited, and the affected portion loses its functional power altogether. In such cases paralysis comes on slowly and increases gradually. It is often accompanied by contractions of the paralysed part. The patient grows dull and apathetic, and passes urine and fæces involuntarily; bedsores form, and he dies comatose. Where the course is rapid, hemiplegia occurs suddenly, and the symptoms are similar to those of cerebral apoplexy.

Partial anæmia of the brain may also be due to collateral œdema occurring in the vicinity of morbid growths, of cerebral abscesses, and other local diseases of the brain. The symptoms are those of irritation or paralysis, and they accompany those belonging to the original disease. They are the results of a functional disturbance of a portion of the brain beyond the actual seat of the disease. Thus, paralysis accompanying diseases of the cortical and medullary portion is due to anæmia of deeper parts of the cerebrum. Similarly we find hemiplegia accompanying disease of one or the other side of the cerebellum is due to collateral œdema of portions of the brain.

The œdema may extend along the crura cerebelli to the lateral regions of the pons, and give rise to hemiplegia of the opposite side; while in those cases where the same side is affected the collateral œdema has extended along the inferior peduncle to the medulla oblongata.

Partial anæmia may also result from compression of the capillaries of the brain by effusion of blood, tumour, or any local disease affecting the large hemispheres. The compression causes pressure on the brain, lessens the space, and thus leads to constant and characteristic symptoms. Among these hemiplegia is most common.

Terminations.—If the anæmia be due to exhaustive diseases it will pass off as recovery takes place. In other cases the termination will depend upon the nature of the case. If embolism or thrombosis be the cause the hemiplegia will probably continue, and contraction and muscular wasting result. The intellect may also fail, and the patient becomes bedridden and childish; bedsores are then common, and occur early. Aphasia may persist or pass off in part. It usually improves soon, if at all.

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Treatment.—In cases in which exhausting discharges are the cause of the cerebral affection, and the blood is diminished in quantity and altered in quality, attempts should be directed towards the improvement of these conditions.

In children, if the symptoms be due to diarrhœa, they can best be dealt with by the administration of raw-meat juice and wine, and by the injection of acetate of lead and liquid extract of opium into the rectum. Strong wines, soups, and other stimulants, as ether, musk, of the limbs, or even convulsions. In a short time the patient is bathed in a profuse perspiration; the pupils are dilated, and the respiration is slow and oppressed. Where cerebral anæmia is the result of slow processes, such as prolonged hæmorrhages or discharges, we find at first symptoms of cerebral irritation, which sooner or later merge into those of depression. The most marked symptoms are those of disordered sensibility. There is severe headache, either in the forehead or the occiput, intolerance of light, with flashes before the eyes; a sense of dizziness, with noises in the ears. In anæmia of the brain in children, the symptoms resemble those of acute hydrocephalus. In the early stage the child is restless and irritable, tosses about in bed, grinds its teeth, and cries out in its sleep. The limbs twitch or there are convulsions; the face is flushed, the pupils are contracted; the child cries on being touched. The temperature may be 102° or 103°. In advanced cases the restlessness is followed by drowsiness, from which the child is roused with difficulty. The face becomes pale and cool, and the pupils insensible to light. The child lies with its eyes half closed. Such cases end fatally unless promptly treated.

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In children, if the symptoms be due to diarrhœa, they can best be dealt with by the administration of raw-meat juice and wine, and by the injection of acetate of lead and liquid extract of opium into the rectum. Strong wines, soups, and other stimulants, as ether, musk, and camphor, are of great service where the patient is extremely restless, and there are twitchings of the limbs or convulsions. Where there has been excessive loss of blood transfusion may be recommended. After tedious fevers, in which there has been excessive waste of the tissues of the body, with great reduction of the power of assimilation, cerebral anæmia is often a marked symptom. In such patients extreme care and precaution are necessary during convalescence. They sometimes die suddenly from cerebral anæmia, due to the above causes and to weakness of the heart's action. Patients recovering from severe fever should be warned not to assume the erect position too rapidly.

When threatening symptoms occur, and the heart is weak and feeble in its action, mustard plasters to the calves and to the præcordia may be used with advantage. In cases of partial anæmia, due to thrombosis or embolism, treatment is of little benefit. The obstruction cannot be removed, and the only means of prolonging life is to endeavour to promote collateral circulation. For this purpose a stimulating plan of treatment must be adopted. On the other hand, if the head is hot and the temples throb, and there are other symptoms pointing to hyperæmia of the cerebral vessels, constant cold to the head or cold douches should be applied. Leeches also may from time to time be applied behind the ears. Blisters to the scalp or to the nape of the neck will assist in relieving the collateral œdema. Depletion of a more active character must be avoided or used with great caution. If the attack were due to atheroma bleeding would induce greater thinness of the blood, and, by further diminishing its power of coagulation, would increase the mischief. If the bowels are constipated compound jalap powder or a drop of croton oil may be given. The diet should be liquid and nutritious, stimulants being avoided or given with great care. For sleeplessness chloral hydrate and henbane may be given according to circumstances. Bromide of potassium should be avoided; it produces an anæmic condition of the central nervous system. Where there is cardiac disease, and the heart's action is rapid and tumultuous, digitalis may be given with benefit; where there is general anæmia in such cases, a combination of digitalis and iron will be found very serviceable.

Cerebral Hæmorrhage—Apoplexy.

Apoplexy is most frequently associated with extravasation of blood within the cranium; but, besides this, it is a prominent symptom in some cases of congestion, embolism, thrombosis, and serous effusion into the ventricles of the brain. The term signifies a stroke; the patient in some cases falling down suddenly as if from a blow. There is in apoplexy a more or less sudden and complete loss of power of sensation and motion, the patient lying in a state of profound coma, respiration and the action of the heart continuing, but more or less affected. Escape of blood into the substance of other organs, *e. g.* the lungs, is sometimes described as apoplexy of the affected part.

Causes.—Structural disease of the blood-vessels is present in almost every case of apoplexy, and is frequently associated with cardiac hypertrophy. The disease is rare before forty, and it occurs with equal frequency in males and females. Sedentary habits, intemperance in food or drink, the cessation of habitual discharges, the gouty diathesis, and diseases of the kidneys, all predispose to it. Thomson's lines express the most common immediate cause:

> "*Whilst apoplexy crammed intemperance knocks*
> *Down to the ground at once, as butcher felleth ox.*"

In those, also, who are ill-fed and cachectic, and among the chlorotic, there is a tendency of the arterial coats to degenerate, and hence the cerebral vessels become more fragile and apt to rupture. Weakened condition of the vessels, as in scurvy, and during convalescence from acute infectious fevers, is an occasional cause of cerebral hæmorrhage. A far more frequent cause is plethora, due to high living and luxurious habits. The local cause of apoplexy is hæmorrhage from a small cerebral artery, or from the capillaries. The hæmorrhage is the result of rupture of a diseased vessel and of increased pressure of blood against its walls. Any diseased condition of the portion of the brain surrounding the vessels renders hæmorrhage more prone to occur. Another local cause is obstruction of a small cerebral artery. In cases of heart disease, chiefly hypertrophy of the left ventricle, rupture of the cerebral vessels, which sometimes occurs, is the result of the increased pressure of blood upon them. Persons with protuberant bellies, large heads, florid complexions, and short thick necks, although said to be the usual subjects of apoplexy, are not especially predisposed to its attacks.

Morbid appearances.—So far as the brain is concerned they vary with the seat of the hæmorrhage. The arteries at the base are often atheromatous. In small capillary hæmorrhages the brain-substance between the extravasations is either of normal colour and consistence, or considerably altered, and yellow or reddish in colour. It is often soft and pulpy, and then presents the appearance of the condition known as red softening. There is sometimes effusion of blood on the surface of one hemisphere. More often internally a tract of brain-substance exhibits a chasm, which is occupied by a clot, and the brain-substance around is softened. If the hæmorrhage have been into the corpus striatum or the optic thalamus, the clot will be in the ventricle, as in the torn brain-substance, and owing to the distension of the ventricle the convolutions on that side may be flattened. If the hæmorrhage have reached the roof of the ventricle, sometimes one cerebral hemisphere hangs as a mere bag. It is not often easy to find the actual point of rupture of the vessel. Granular kidney, hypertrophy of the left ventricle, and atheromatous aorta are found in a great many cases; and associated with these there may be slight anasarca. Hæmorrhage is divided into capillary hæmorrhage and hæmorrhagic clots. When the hæmorrhage is from the capillaries, it may be in scattered clots or effusions not larger than a pin's head; when it occurs from larger vessels, the quantity of blood may be sufficient to fill the ventricles, and even envelope the medulla and the posterior surface of the cerebellum.

Characters of the effused blood.—The character of the effused blood varies. When in small quantity and recent, it may be fluid, or partly coagulated, dark-coloured, and in clots. When large it consists of blood and broken down brain-substance. The fibrin is deposited at the periphery, with fluid blood in the centre. Small spots cause separation of the fibres of the brain. The effusion is elongated and in the direction of brain filaments, and where a cavity is formed its walls are smooth. Large hæmorrhagic spots dislodge part of the brain-substance, and a cavity is produced, the walls of which are ragged, the cavity being surrounded by soft and broken-down brain-tissue, discoloured with blood. Hæmorrhagic effusions are generally single. After a time the contents of the clot, viz. the fibrin of the blood and the brain-substance, become more closely mixed and more fluid, the colour changes to brown and then to dark yellow. In far advanced cases the exudation products are sometimes converted into granular pigments and hæmatoidin crystals. In the immediate vicinity of the clot, the neuroglia forms a thick dense wall of a new connective tissue. Then contraction takes place, the cavity is lessened in size, the elements of the effusion break down, and their place is supplied by serum, which is contained in a cyst traversed by fibrous bands. The cyst may still further contract and the serum become absorbed, and a hardened spot or cicatrix be all that remains. At other times the cavity does not contract, but remains distended with blood, and its presence favours a renewal of the hæmorrhage. Occasionally it gives rise to inflammation in the vicinity of the broken-down tissue, with inflammatory softening as the result, or the clot may be converted into an abscess.

Effects of hæmorrhage on the surrounding tissues.—The neighbouring parts untouched by the hæmorrhage are particularly anæmic. The subarachnoid space is empty. Hæmorrhage, when extensive, leads to flattening of the convolutions and obliteration of the sulci; it also leads to breaking up of the brain-substance or to softening and œdema of the surrounding brain-tissue, and in some cases to cerebral inflammatory mischief. The presence of blood-crystals in a small vacuity in the brain is a proof of a former hæmorrhage.

Seat of hæmorrhage.—In five cases out of six this is found in the corpus striatum and optic thalamus. The medullary white substance of the hemispheres comes next in order in this respect. It is rare in the cortical portion of the cerebrum, the pons, and the cerebellum, and very rare indeed in the medulla oblongata and corpora quadrigemina. The quantity of blood varies from a few drops to several ounces; when in the vicinity of a ventricle the blood-clot often breaks through the wall; if near the surface of the brain it may escape through the cortex and pia mater into the subarachnoid space.

Results of hæmorrhage.—These are—1. Compression of the capillaries and collateral œdema. 2. Atrophy of the brain with degeneration. Where the clot is small, and the brain-filaments and ganglion cells are not broken down, but only pressed apart, paralysis is temporary. Extensive clots often leave paralysis, which also sooner or later disappears. This is due to either a partial absorption of the effusion, by which the capillaries of the motor centres are relieved of their pressure, or the subsidence of the collateral œdema which may have been set up in the vicinity of the broken-down brain substance. Hemiplegia is found in most but not in all cases. The general nutrition of the brain is altered. In almost every case of apoplexy there is gradual diminution of mental powers. There is a sort of atrophy of the brain, with degeneration, and this has the result of causing partial paralysis. When there is a small clot or effusion pressing on the cortical substance of the cerebrum, there are often general convulsions, with paralysis of the opposite half of the body. The symptoms are generally temporary. Extensive hæmorrhage in parts of the cerebrum other than the corpus striatum and optic thalamus may also produce hemiplegia, but it is only temporary. In hæmorrhage into the cortical substance of the cerebrum there is a severe disturbance of psychical functions, as evidenced by stupor, delirium, mania, &c. Great degeneration of the cortical substance of one hemisphere often produces no symptoms, and the disturbances referred to are probably due to pressure on the other half of the brain, as well as to complicating inflammation of the pia mater. Where the clot is very large, and causes destruction of the corpus striatum or the optic thalamus, hemiplegia is constant and never disappears. Slight hæmorrhage in the pons and medulla oblongata usually causes paralysis, and ends in death. Hæmorrhage into the lateral portions of the pons leads to paralysis of the opposite side of the body, associated with anæsthesia. In extravasations in the middle of the pons there is paralysis of both sides. In hæmorrhage of the cerebellum there is often paralysis of the opposite side, but this cannot depend on affection of the cerebellum, for there is often no paralysis when this portion of the nervous system is extensively destroyed. Hæmorrhages affecting the third or inferior frontal convolution (Broca's convolution), particularly of the left hemisphere, cause aphasia, owing to the breach in the mechanism for translating ideas into words. In apoplexy affecting the crura cerebri there is marked anæsthesia, squinting, and slight facial palsy. When a clot makes its way into the meninges, or into the ventricles, death is the result. There are epileptiform convulsions, and paralysis is followed by rigidity in a very few hours. Slight effusion below the tentorium is very dangerous. When it occurs, the medulla oblongata is not protected by the tentorium from pressure, as is the case when the hæmorrhage occurs in parts which are seated above that structure.

Symptoms.—These are the results of local injury and of the general disturbance of the functions of the brain. Sometimes the attack sets in suddenly, without any warning, but there are often certain premonitory symptoms or peculiar sensations, which are popularly known as warnings of apoplexy. Increased cardiac impulse and other indications of derangement of the heart's action are frequent precursory symptoms. The premonitory symptoms are often those of general or partial cerebral congestion, and include feelings of heaviness or fulness in the head, or headache, noises in the ears, flashes before the eyes, dimness of sight or double vision, dizziness, and restlessness. The patient is often excited and irritable. In other cases there are formication and numbness in the hands and feet and other parts, repeated hæmorrhages from the nose, torpid bowels, and scanty urine; partial loss of memory, or mental depression, peevishness, transient delusions, incoherent speech, drowsiness with stupor, and a slight and temporary hemiplegia. These symptoms indicate the existence of degeneration of the cerebral vessels, and of course may or may not be followed by apoplexy.

Symptoms of seizure.—Small extravasations give rise to purely local symptoms. The escape of blood from the ruptured capillaries continues only till the tension is removed. Apoplexy may exist without the symptoms of a fit, and without hemiplegia. It may cause slight facial palsy, amaurosis of one eye, ptosis, &c. The patient may be in apparently good health, and may find his articulation suddenly to become thick, and his mouth drawn to one side; or, in a few cases, the patient on rising from bed in the morning finds one side of his body totally useless. Cases of this kind are, however, rare.

In the majority of cases the hæmorrhage is extensive, and the attack sets in suddenly. The consciousness is entirely lost, as well as the capacity for motion and sensation. In copious hæmorrhage there is sudden compression of the capillaries and cerebral anæmia as a result. To this latter condition the symptoms are really due. The majority of cases of hæmorrhage, wherever its seat, show great similarity of symptoms. As a general rule there is hemiplegia. Another series of symptoms depends on the general effects produced on the rest of the brain. Thus, the patient falls down suddenly; there is a sudden loss of consciousness. The skin is cold and clammy, the face pale, the eyes glassy, the teeth clenched, and there is inability to swallow; the sphincters are relaxed. There is involuntary passage of urine and fæces. Retention of urine sometimes happens, and causes distension of the bladder and dribbling. During the fit the respiration continues, because the tentorium protects the medulla from the evil effects of the hæmorrhage. The inspirations follow each other at long intervals. The breathing is loud and stertorous; stertor is due to the falling back of the tongue, and also to the paralysis of the soft palate, which is made to vibrate by the inhaled air. The lips and cheeks puff out with each expiration. There is often vomiting. The pulse is very slow and the pupils are contracted, or dilated and insensible to light, and often unequal. It was usually supposed that the fit or the symptoms of paralysis were due to the pressure of the extravasation on the brain-filaments and ganglion-cells, but it is more probable that the symptoms are the result of a sudden compression of the cerebral capillaries leading to anæmia of the brain-substance. The existence of this anæmia can be recognised on post-mortem examination. The pulsation of the carotids, so frequently observed in such cases, indicates that the flow of blood to the head is obstructed. If the throbbing occurs, and there is no hypertrophy of the left ventricle to account for it, this sign is very important as indicating hæmorrhage, or that the attack is due to the presence of some exudation, tumour, or other disease encroaching upon the cavity of the cranium.

In those cases in which life is prolonged for some days after the attack, more or less marked symptoms of encephalitis generally make their appearance. These are due to the irritation set up by the extravasation, and resemble those which are observed in traumatic cases. They consist of increased frequency of pulse, headache, delirium, and twitchings or convulsions of the affected side. These symptoms may eventually pass off, but in some cases death occurs from meningitis or from abscess, or a condition of general paralysis becomes developed.

The symptoms of the apoplectic attack assume various forms, which depend upon the amount of blood effused, the number and seat of the lesions, and the rapidity or slowness with which the hæmorrhage takes place. In a somewhat numerous class of cases the attack occurs suddenly, either with or without some premonitory symptoms. There is a sudden fit at the outset, consciousness is not recovered, and the paralysis extends to the medulla oblongata. In these cases the breathing is irregular, the pulse intermittent and slow, the pupils are dilated, and death takes place in a few minutes or a few hours. In a second class, which is somewhat more frequent, the patient falls down suddenly, and becomes at once insensible. During the unconsciousness the face appears distorted, one pupil is dilated, and there is relaxation of the muscles of the limbs on one side. After a few hours consciousness returns, but the speech is affected, and hemiplegia remains; after a day or two fever and other symptoms of encephalitis set in, as described in a previous paragraph. These symptoms gradually abate, but the paralysis remains for the rest of life. In another class of cases hæmorrhage ceases for a time and then recurs, and this condition is repeated. The patient partly recovers consciousness, and then, after a few hours, falls back insensible. The coma gradually becomes more profound until death takes place. In another form there is severe pain in the head for a few days, causing the patient to cry out. Sooner or later he becomes pale and faint and drops down insensible, as if in a state of syncope. There is at first a marked loss of consciousness, from which he soon recovers, but the headache continues; the mind becomes dull and forgetful, and the patient's manner strange. There is at length complete hemiplegia and facial paralysis. The breathing is stertorous, and at last the patient becomes drowsy, comatose, and dies. In another set of cases, where the hæmorrhage is slow at first and gradually increases, there is hemiplegia from the very commencement, but later on there is loss of consciousness and general paralysis of the brain. In a few rare cases of apoplexy, instead of hemiplegia, there is paralysis of both sides of the body, in such cases one or more lesions exist in each hemisphere of the brain. The symptoms are unequal on the two sides of the body.

Duration.—Apoplexy is associated with immediate death in popular belief, but the impression is erroneous, as death rarely occurs before several hours have elapsed. By far the most common cause of the sudden deaths we read of in newspapers is aortic disease.

Termination.—Where the hæmorrhage is only slight and hemiplegia the only result, the patient gradually recovers. In most cases the recovery is partial, and very slow in its progress, owing to some of the conducting nerve-fibres being absolutely severed by the effused blood; the power of motion is therefore not completely restored. Immediately after the attack the muscles are flaccid, and respond to both forms of electricity. The reflex excitability is also retained. The temperature of the paralysed limbs is slightly increased. After a time the muscles become rigid, the temperature falls below the normal, and the hands and feet swell. This change from flaccidity to rigidity is a sign of grave import as regards the prospect of restoration. In some cases the arm, and especially the shoulder, becomes painful, red, swollen, and rigid, and the condition of the part may be mistaken for rheumatism. Generally the leg recovers before the arm. Where the arm recovers first it is believed that the case is a bad one, and that the hæmorrhage was in the inferior part of the posterior lobe of the cerebrum. The permanent contraction of the limb, with wasting of the muscles, occurs where the paralysis has lasted for a very long time.

Diagnosis.—If the attack be of an ordinary kind, and there is sudden pain in the head and giddiness, followed by hemiplegia, the diagnosis is easy. If there be deep coma after a sudden fall, and there is also paralysis, the diagnosis is difficult. It may be a case of injury, of poisoning, or drunkenness. In complete insensibility from any cause there may be a large quantity of effusion at the base of the brain or in the pons, and the pupils are contracted. In opium-poisoning there is very slow breathing, and *marked contraction of the pupils.* In apoplexy the patient often passes fæces involuntarily soon after the fall; this symptom is not common in poisoning or drunkenness. If the patient be semi-conscious the case may be mistaken for concussion, drunkenness, or uræmic poison. In these cases the pupils are of ordinary size, and there is no paralysis. A sudden attack of hemiplegia without loss of consciousness generally indicates embolism, especially if the patient has previously suffered from heart-disease. In effusion, on the other hand, the attack takes place more slowly. Capillary hæmorrhages, associated with softening, produce complete loss of motor power and more or less diminution of sensibility. In cases of uræmic coma albumen will be found in the urine. In poisoning from opium and alcohol the peculiar odour will be detected in the breath and vomited matters.

The *prognosis* of course depends on the seat and extent of the tract of brain-substance exhibits a chasm, which is occupied by a clot, and the brain-substance around is softened. If the hæmorrhage have been into the corpus striatum or the optic thalamus, the clot will be in the ventricle, as in the torn brain-substance, and owing to the distension of the ventricle the convolutions on that side may be flattened. If the hæmorrhage have reached the roof of the ventricle, sometimes one cerebral hemisphere hangs as a mere bag. It is not often easy to find the actual point of rupture of the vessel. Granular kidney, hypertrophy of the left ventricle, and atheromatous aorta are found in a great many cases; and associated with these there may be slight anasarca. Hæmorrhage is divided into capillary hæmorrhage and hæmorrhagic clots. When the hæmorrhage is from the capillaries, it may be in scattered clots or effusions not larger than a pin's head; when it occurs from larger vessels, the quantity of blood may be sufficient to fill the ventricles, and even envelope the medulla and the posterior surface of the cerebellum.

Characters of the effused blood.—The character of the effused blood varies. When in small quantity and recent, it may be fluid, or partly coagulated, dark-coloured, and in clots. When large it consists of blood and broken down brain-substance. The fibrin is deposited at the periphery, with fluid blood in the centre. Small spots cause separation of the fibres of the brain. The effusion is elongated and in the direction of brain filaments, and where a cavity is formed its walls are smooth. Large hæmorrhagic spots dislodge part of the brain-substance, and a cavity is produced, the walls of which are ragged, the cavity being surrounded by soft and broken-down brain-tissue, discoloured with blood. Hæmorrhagic effusions are generally single. After a time the contents of the clot, viz. the fibrin of the blood and the brain-substance, become more closely mixed and more fluid, the colour changes to brown and then to dark yellow. In far advanced cases the exudation products are sometimes converted into granular pigments and hæmatoidin crystals. In the immediate vicinity of the clot, the neuroglia forms a thick dense wall of a new connective tissue. Then contraction takes place, the cavity is lessened in size, the elements of the effusion break down, and their place is supplied by serum, which is contained in a cyst traversed by fibrous bands. The cyst may still further contract and the serum become absorbed, and a hardened spot or cicatrix be all that remains. At other times the cavity does not contract, but remains distended with blood, and its presence favours a renewal of the hæmorrhage. Occasionally it gives rise to inflammation in the vicinity of the broken-down tissue, with inflammatory softening as the result, or the clot may be converted into an abscess.

mustard plasters to the præcordia and to the calves. If the patient can swallow, active purgatives are serviceable. Where the power of deglutition is lost two or three drops of croton oil should be put on the tongue, and stimulating enemata of castor oil and turpentine should be thrown up the rectum. One grain of ergotine may be injected every half hour into the subcutaneous tissue, with the view of arresting further hæmorrhage. If the urine is retained it must be withdrawn by a catheter. The patient must be removed into a cool room, and should be placed on his side to avoid stertor. The head should be placed high on pillows, and the dress about the neck should be loosened. Should the patient recover from the attack the head should be shaved, and then covered with a bladder of ice or cold compresses. The bowels must of course be kept freely open, and the patient should be restricted to non-stimulating liquid diet for a long time. By this plan of treatment any tendency to inflammation (encephalitis) is lessened. If, notwithstanding all the precautions, encephalitis sets in, the inflammation must be combated by a free purge, application of a few leeches behind the ears, and other derivatives to the skin and kidneys. Blisters to the neck may be prescribed, but with great caution. The paralysis that so often remains after an attack may frequently be relieved by careful attention to hygiene. The patient should be placed under careful nursing. Change of air and warm baths are often beneficial. The induced current of electricity may be tried when all active symptoms have subsided.

MENINGEAL APOPLEXY; HÆMORRHAGES OF THE CEREBRAL MEMBRANES; HÆMATOMA OF THE DURA MATER.

Hæmatoma signifies a blood-tumour, or a collection of blood. It is rare in connection with the cerebral membranes, except as a result of injury. It is sometimes due to the breaking through of the hæmorrhage in the cortical substance of the brain. When it occurs the effusion is found in the subarachnoid space, or between the dura mater and the arachnoid. Degeneration of the arteries may lead to it.

Pathology.—Hæmatoma of the dura mater is due to repeated hæmorrhagic exudation, and not to simple extravasation of blood, as was at one time supposed. There is at first chronic inflammation of the dura mater, leading to pseudo-membranous formation, and not a simple extravasation, at whose periphery the fibrin has been precipitated and the fluid part encapsulated. The blood filling the sac of the hæmatoma comes from numerous thick-walled capillaries that have formed in the inflammatory pseudo-membrane of the dura mater, and has been effused between the layers.

Causes.—These are for the most part unknown. The lesion occurs chiefly in persons emaciated by chronic disease, in cases of degeneration of the arteries, and in drunkards. In some cases it develops from injury of the brow. It is common in children; one-third of the deaths in stillborn children is due to this affection. The vessels are lacerated by the edges of the cranial bones.

Anatomical appearances.—On opening the skull the dura mater on the affected side is loose and pendulous. If the effusion be in the subarachnoid space, and the arachnoid be not torn, the extravasation will not wash off. A large clot of dark-coloured blood may cover a great portion of the superior surface of the hemisphere. The blood effused undergoes certain changes. It is fluid at first, but after four or five days it coagulates, the serum is absorbed, and the clot becomes adherent to the parietal layer of the serous membrane. Usually a part of the extravasation reaches the ventricles, and we find more or less blood in them, or the ventricles may contain a little clear serum. Hæmatoma is generally found near the sagittal suture, and in the form of a flat oval sac, which may be four or five inches in length, two to three inches broad, and about half an inch thick. Its walls are rusty brown, and contain altered hæmatin and shreds of membrane. It contains fluid blood and coagulated clots in the form of fibrinous lamellæ. The corresponding half of the cerebrum is flattened or even depressed. The hæmatoma sometimes occurs on both sides. The brain-substance is healthy.

Symptoms.—Even if the hæmatoma be uncomplicated with cerebral hæmorrhage it gives rise to an apoplectic fit, which may rapidly cause death. The hæmorrhage is diffuse, and hence the lesion is seldom accompanied by hemiplegia. Severe circumscribed headache and general convulsions point to the existence of meningeal hæmorrhage. Constant contraction of the pupil is regarded as an important sign.

Diagnosis.—It may be mistaken for acute meningitis in children. In meningeal apoplexy the symptoms are less inflammatory, the invasion more sudden, and the loss of voluntary power more complete.

Treatment.—If the disease be diagnosed during life, the constant application of ice to the head and the administration of purgatives are likely to prove beneficial. In other respects the treatment is the same as for cerebral apoplexy.

INFLAMMATION OF THE MEMBRANES OF THE BRAIN.

This includes — 1st, inflammation of the dura mater and its sinuses; 2nd, inflammation of the pia mater (fibrinous); 3rd, inflammation of the pia mater (tuberculous); and 4th, cerebro-spinal meningitis.

INFLAMMATION OF THE DURA MATER AND ITS SINUSES.

This is otherwise known as *pachymeningitis externa*. It is seldom a primary affection. As a secondary disorder, it is generally of a traumatic origin; injury, *e.g.* fracture, and caries of the cranial bones, especially the ethmoid and the petrous portion of the temporal bones, are its most frequent causes. Inflammation of the lateral and petrosal sinuses, with consequent thrombosis, or thromboses followed by the former process, are not very rare. They occur in cases of caries of the temporal bones, and in persons who suffer from chronic otitis interna, or tedious otorrhœa. It is very doubtful whether exposure to cold or other similar causes are sufficient to produce inflammation of the dura mater.

Post-mortem appearances.—When the inflammation extends from the bones of the skull, it may involve all the membranes extensively, or be localised to the dura mater. In cases where there has been prolonged otorrhœa, we find extensive caries of the petrous bone, the tympanum full of fœtid pus; the labyrinth, the mastoid cells, and the cochlea more or less infiltrated, and the drum destroyed. In long-continued cases, the dura mater is thick, soft, and loosened from the bone. Sometimes, however, it is firmly adherent to the surface of the bone. This adhesion and thickening of the dura mater are due to the proliferation of connective tissue on its outer surface. In the early stage in acute cases the dura mater appears red and injected, and the portions corresponding to the caries of the bone, or the points of injury, are thick and infiltrated. In advanced cases, the dura mater appears softened and of a dirty greyish-yellow colour. Suppuration takes place between the dura mater and the cranium, and often pus escapes into the arachnoid cavity. The pia mater is almost always inflamed. When meningitis is due to diseases of the temporal bone, the cerebral sinuses become inflamed and thrombosis results. The thrombi at first adhere to the rough inner surface of the thickened wall of the sinus; but when they become disintegrated the sinus is filled with pus, or sanious fluid mixed with flocculi.

Symptoms.—These are modified according to the symptoms of the original disease, and by complications, such as the extension of the disease to the pia mater, and to the cerebral sinuses. Acute inflammation of the dura mater is almost always due to chronic otitis interna; the patient may have suffered for years from deafness of one ear and more or less copious and offensive discharge, and also from pain, and then, owing to sudden or undue exposure to cold, or a blow on the affected ear, or without any obvious cause, meningitis occurs. In many cases, when the inflammation sets in, the discharge from the ear suddenly ceases. At first the patient complains of severe pain in the vicinity of the diseased ear, or of headache, or of vomiting and rigor; these are soon followed by fever. Other symptoms are due to irritation of the brain: thus, there may be dizziness, noises in the ears, an early and violent delirium, contracted pupils, strabismus, great irritability of temper, and intolerance of light and sound. The tongue is coated, the face is flushed, there is hard pulse and twitchings of muscles. These symptoms are subsequently followed by those of depression; sometimes there are convulsions or prostration, followed by drowsiness or coma, or the delirium soon merges into collapse, or a state of general paralysis occurs. All these symptoms are not necessarily present in the same case. The symptoms of depression are probably due to the extension of the disease to the pia mater. The disease very often has its origin in thrombosis of the cerebral sinuses. In most cases the setting in of rigors and signs of metastatic inflammation in the lungs indicate that the caries of the petrous bone has induced meningitis externa, and has also led to thrombosis in the cerebral sinuses.

Treatment.—Sudden cessation of the discharge from the ear is often one of the premonitory signs of pachymeningitis externa, and should therefore be treated by warm fomentations or by leeches behind the ears. These measures will aid in reducing the inflammatory action, and they may be supplemented by counter-irritation behind the ear, and at the back of the neck. Severe pain and tenderness in the head, and great excitement and intolerance of light, may be relieved by keeping the patient in a dark, cool, and well-ventilated room, and by the application of ice to the head. The bowels should be freely acted on, and vascular excitement should be lessened by depressants, as aconite, veratria, and digitalis, aided by salines. If the subject be of a scrofulous habit, syrup of the iodide of iron, or the iodide of potassium, may be given. The diet should be liquid and nourishing, and given repeatedly; vomiting may be checked by mustard plaster to the pit of the stomach. In chronic cases some benefit may be hoped for from counter-irritation, kept up for some time behind the mastoid process. In scrofulous cases, the treatment for the diathesis must be sedulously adopted.

INFLAMMATION OF THE PIA MATER; SIMPLE MENINGITIS.

Simple meningitis is an inflammation of the pia mater of the brain. It is otherwise known as meningitis of the convexity. It occurs in two forms, acute and chronic. In the former there is exudation into the subarachnoid space; in the latter the pia mater and arachnoid are opaque and thickened, owing to development of connective tissue.

Causes—predisposing.—It is most frequent among cachectic adult males, in those whose constitution has been debilitated from previous long illness, as pneumonia, pleurisy, acute specific fevers, &c. It also occurs as a sequel of protracted diarrhœa, rheumatism, and Bright's disease, and in persons exposed to great heat, as in hot climates, and especially in those who at the same time indulge in various excesses and abuse of intoxicating liquors.

Exciting.—Direct injury to the membranes; extension of inflammation, as from diseases of the bones of the nose or of the ear; erysipelas of the head or face; irritation from adventitious growths (cerebral); syphilitic affections of the bones of the skull, chilling of the body, getting wet, &c.

Post-mortem appearances.—In this affection the membrane covering the convexity of the cerebrum is inflamed; and there is puro-fibrinous exudation. Where death takes place early the pia mater appears red and highly vascular, and covered with patches of extravasation. The sac of the arachnoid contains pus-cells and fine granular fibrin. Occasionally the arachnoid is covered over with fibrin or bathed in pus. There is frequently an opaque exudation covering the cortical portions of the brain and the sulci between the convolutions. The cortical substance may be healthy and normal, but sometimes it is soft. The ventricles are empty. In long-continued cases the superficial layer of the grey matter of the brain is found to be red, soft, and often adherent to the pia mater, which is thick and cloudy. In some cases even the ventricles contain an excess of serum or pus, and their walls are covered with exudation.

Symptoms.—Sometimes the disease sets in with convulsions or with vomiting, and sometimes with a rigor, or a chill followed by febrile phenomena, as high fever, very frequent hard pulse, great thirst, white and furred tongue, as in acute and extensive inflammation of other organs. The patient in acute cases dies in two or three days, but life may be prolonged for months. When the disease has become established, the chief cerebral symptoms follow. These refer original disease, and by complications, such as the extension of the disease to the pia mater, and to the cerebral sinuses. Acute inflammation of the dura mater is almost always due to chronic otitis interna; the patient may have suffered for years from deafness of one ear and more or less copious and offensive discharge, and also from pain, and then, owing to sudden or undue exposure to cold, or a blow on the affected ear, or without any obvious cause, meningitis occurs. In many cases, when the inflammation sets in, the discharge from the ear suddenly ceases. At first the patient complains of severe pain in the vicinity of the diseased ear, or of headache, or of vomiting and rigor; these are soon followed by fever. Other symptoms are due to irritation of the brain: thus, there may be dizziness, noises in the ears, an early and violent delirium, contracted pupils, strabismus, great irritability of temper, and intolerance of light and sound. The tongue is coated, the face is flushed, there is hard pulse and twitchings of muscles. These symptoms are subsequently followed by those of depression; sometimes there are convulsions or prostration, followed by drowsiness or coma, or the delirium soon merges into collapse, or a state of general paralysis occurs. All these symptoms are not necessarily present in the same case. The symptoms of depression are probably due to the extension of the disease to the pia mater. The disease very often has its origin in thrombosis of the cerebral sinuses. In most cases the setting in of rigors and signs of metastatic inflammation in the lungs indicate that the caries of the petrous bone has induced meningitis externa, and has also led to thrombosis in the cerebral sinuses.

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Post-mortem appearances.—In this affection the membrane covering the convexity of the cerebrum is inflamed; and there is purofibrinous exudation. Where death takes place early the pia mater appears red and highly vascular, and covered with patches of extravasation. The sac of the arachnoid contains pus-cells and fine granular fibrin. Occasionally the arachnoid is covered over with fibrin or bathed in pus. There is frequently an opaque exudation covering the cortical portions of the brain and the sulci between the convolutions. The cortical substance may be healthy and normal, but sometimes it is soft. The ventricles are empty. In long-continued cases the superficial layer of the grey matter of the brain is found to be red, soft, and often adherent to the pia mater, which is thick and cloudy. In some cases even the ventricles contain an excess of serum or pus, and their walls are covered with exudation.

Symptoms.—Sometimes the disease sets in with convulsions or with vomiting, and sometimes with a rigor, or a chill followed by febrile phenomena, as high fever, very frequent hard pulse, great thirst, white and furred tongue, as in acute and extensive inflammation of other organs. The patient in acute cases dies in two or three days, but life may be prolonged for months. When the disease has become established, the chief cerebral symptoms follow. These refer to functional disturbance of the brain, and include those of the first or the stage of excitement, viz. intense and constant headache, increased on the least movement; great heat of the head; flushed face; injected conjunctivæ. The patient frequently grasps the head and moans from pain. Psychical disturbances set in from the onset of the disease. There is violent irritability, restlessness, and sleeplessness, often passing into wild and active delirium. The sensory functions are also disturbed. There is increased or perverted sensibility; most frequently there is hyperæsthesia of the skin and increased sensitiveness to light and sound. The motor disturbances are also marked. The contraction of the muscles of the nape of the neck is a common and often a diagnostic symptom of cerebral meningitis. In some cases retraction of the abdomen is a marked symptom of this disease. There may be a feeling of tingling or formication and increased muscular action, indicated by twitchings of muscles, and even convulsions; the eyeballs are fixed or move convulsively, and the pupils are contracted.

After suffering from these indefinite symptoms the patient often passes into the second stage, that of collapse or depression, or of complete paralysis. There is more or less failure of the cerebral functions, the headache and fever subside, and the delirium is followed by profound sleep and muttering stupor, ending in coma. Sometimes the stupor is followed by the recurrence of excitement, with delirium and even convulsive paroxysms or twitching of muscles. Sometimes consciousness returns. The paralysis is rarely complete. It sometimes affects one arm or one leg, and sometimes the face. Paralyses of the muscles of one of the eyeballs, or of speech or deglutition, are sometimes the main features. The pupils in the second stage are dilated and motionless. The head is hot, but the rest of the body may be below the normal temperature. The pulse is usually slow and intermittent, the tongue dry and brown, the respiration becomes irregular and sighing, the urine is retained, and the patient dies of coma. Death may be preceded by a *third stage.* In this condition there is complete abolition of the cerebral functions, absolute coma, stertorous breathing, involuntary passage of urine and fæces, ending in extreme depression, and ultimately death. The patient generally dies in a few days; the disease rarely lasts for two or three weeks. Chronic meningitis is commonly manifested in the cachectic, whose constitution has been debilitated by excessive drinking, and in insane patients. In them the disease commences with headache, and signs of cerebral irritation and other symptoms of psychical disturbance soon follow. There may be loss of memory, dulness of intellect, trembling of hands, and symptoms of gradually progressing paralysis.

Diagnosis.—Cerebral meningitis is often mistaken for hyperæmia of the brain, but the course of meningitis, the high fever with frequent and hard pulse, and intense headache serve to distinguish the former. In meningitis the prognosis is generally unfavorable, not so in hyperæmia.

Treatment.—Recovery is rare. The source of mischief should be discovered, and if practicable removed. In the early stage the patient must be kept at perfect rest, in a comfortable bed, in a cool well-ventilated room, with the head slightly raised. The room should be closed to all except the nurse, the clothes about the neck and chest should be loose, the head should be shaved, and ice or a cold douche constantly applied to the head. If the subject be plethoric, a few leeches may be applied to the temples. The bowels should be freely acted on by drastic purgatives, as calomel and jalap; the increased general vascular excitement may be relieved by salines and vascular depressants, as aconite, veratria, arnica, digitalis; calomel should be given every two hours till salivation is produced, or bromide of potassium alternated with iodide, or both combined. Friction with mercurial ointment or with oleate of mercury may be superadded. If, notwithstanding such energetic treatment, coma or cerebral palsy set in, a large blister should be applied to the nape of the neck, and antimonial ointment rubbed into the scalp. Repeated cold douches to the head have sometimes a wonderful effect in restoring consciousness. Should convulsions occur, they must be treated by bromide of potassium. Vomiting can sometimes be checked by counter-irritation to the nape of the neck. In the state of extreme prostration stimulants and nourishing food should be administered, either through the mouth or by means of enemata.

TUBERCULAR OR BASILAR MENINGITIS.—ACUTE HYDROCEPHALUS.

It is an inflammation secondary to tubercles in the pia mater, and is otherwise called basilar meningitis. The disease is rarely primary. It is most common in weak, precocious, and scrofulous children, in those already suffering from glandular enlargements, or after recovery from an acute disease. It most frequently occurs in children over two and under seven years of age; it is rare after ten years. A large proportion of cases occur after whooping-cough, croup, and measles. It is very rare in adults, and, when it occurs in them, it is part of a general tuberculosis, or an accompaniment to pulmonary consumption. The disease very rarely, though sometimes, occurs in previously healthy persons, and during convalescence from acute specific diseases. In this inflammation there is a deposit or exudation, containing a few pus-corpuscles, in the subarachnoid

space at the base of the brain. There is also a deposit of grey tubercular granulations in the meninges at the base, along the course of the middle meningeal artery, and occasionally all over the surface. The ventricles are generally found distended with serum, and there is softening of their walls, and of the neighbouring parts. Hence the affection is sometimes termed acute hydrocephalus.

Causes.—A source of infection, such as caseous bronchial glands, usually exists.

Post-mortem appearances. — Tuberculous meningitis is usually accompanied by miliary tubercles in other organs, and by caseous degeneration of the bronchial and mesenteric glands. Caseous deposits in the lungs are often found in children who have died from hydrocephalus. Miliary granulations are found in the pia mater. The hemispheres exhibit more or less evidence of exudation, the surface is greasy to the feel, and the sulci are found to contain streaks of lymph. The convolutions are flattened from exudation of fluid within the ventricles. The tubercles are more abundant, and chiefly seated at the base of the brain, where the disease is generally most marked. A yellowish opaque exudation (serum, lymph, and rarely pus) is found at the base of the brain and in the meninges covering the optic commissure. It also extends forwards along the Sylvian and longitudinal fissures, and backwards towards the pons, medulla oblongata, crura cerebri, and cerebellum. The pia mater in these parts is abundantly dotted over with minute granules, which are either opaque or translucent, grey and firm, or friable. The tubercles or granules are seated in the lymphatic sheaths of blood-vessels. The ventricles of the brain (the lateral and the third) are distended with fluid, which is usually slightly turbid. Their walls, as well as the fornix and commissures, are softened by maceration, and the foramen of Monro is dilated.

Symptoms.—The premonitory stage, as it occurs in children between the ages of two and seven, varies in duration from four to five days. The patient is usually ill-nourished or even emaciated, but cases also occur in well-nourished children, and especially in such as exhibit evidence of excessive mental development. Signs of tubercles are often present, and generally in the lung. They are also found in the bronchial and mesenteric glands. The initial symptoms indicate that the disease is at first of a local character, and confined to a part of the base of the brain, where many important nerves have their origin. Later on the disease extends into the ventricles, which are the seat of inflammatory effusion, as a result of which the brain-substance becomes softened, and other parts become implicated. At first there is general constitutional disturbance, showing the onset of a severe malady. The disease

sometimes sets in suddenly with headache, and in some cases with obstinate vomiting. In other cases there are premonitory symptoms, and this prodromal stage may be protracted for some weeks. The child becomes peevish and irritable, forsakes its play, is easily fatigued, complains of intense headache, is giddy, screams and grinds its teeth, and starts from sleep, as if alarmed, without any apparent cause. A short, dry cough is sometimes noticed, and there are occasional accessions of fever; the temperature ranging from 100° to 103°. This state lasts for days or weeks. The vomiting is often a prominent symptom; it occurs at irregular intervals, and is not due to improper food. There is generally constipation, and the abdomen appears sunken. When the disease is established, the symptoms indicate cerebral irritation, and afterwards depression. Of the signs of the former condition, headache and vomiting are most marked. Other symptoms occur in the parts supplied by the nerves of the eye and by the vagus. The acuteness of the special senses is increased; the eyelids are closed to avoid light; there is at first contraction, and later on dilatation, of the pupils; frequency, followed by slowness of the pulse; hurried respiration and retracted abdomen. Owing to extensive disease of the cerebrum, there is loss of consciousness, epileptiform convulsions, and more or less paralysis of the extremities. The disease may be said to exhibit three stages. During the first, or stage of invasion, there is a slight rise of temperature and other phenomena of nervous irritation. The countenance is expressive of anxiety and suffering, is alternately flushed and pale; the eyes are closed, the eyebrows knit, and the pupils contracted. The child complains of headache and sleepiness. Headache is shown by the hands being carried to the head; and he utters a piercing shriek, called the hydrocephalic cry. The pulse is frequent, the respirations irregular and sighing, and *tâche cérébrale* well marked. (*Tâche cérébrale* is a vivid red mark elicited by drawing the back of the nail sharply along the skin of the abdomen.) The child has a strong tendency to sleep, the pain in the head and other symptoms subside for a time, or there is remission, when the patient looks somewhat better, but this is not followed by any continued improvement. In the second stage, the symptoms are those which are due to the pressure exercised by the inflammatory deposits. Thus there is diminution or cessation of fever, the pulse is slow, and instead of nervous irritability there is commencing paralysis. In a few cases there is hemiplegia, which deserves notice, as it may lead to an error in diagnosis. Hemiplegia occurs because the hydrocephalic softening is more advanced on one side than on the other. The patient becomes somnolent, gradually stupor and heaviness come on, the pupils become dilated and sluggish, the

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patient lies on his back in a state of insensibility, occasionally crying out, picking with tremulous fingers his nose and lips, and with his eyes half closed or staring, and never asking for food. The respirations are irregular in rhythm, the pulse is slow, faltering, and may be intermittent or irregular. The patient becomes comatose, and there is involuntary passage of urine and fæces, or the urine is retained in the bladder, which becomes distended. Diarrhœa sets in, and is accompanied by cold sweats. Some paralysis frequently occurs, especially ptosis; very often convulsions set in. In the third stage, the cerebral functions are abolished, and there is coma and paralysis, or epileptiform convulsions. The drowsiness, from which the patient could before be roused, though with difficulty, now passes into profound coma. The child does not respond at all to external influences. The pulse is exceedingly feeble and frequent, and the extremities cold, or violent convulsions take place at intervals; with squinting and dilated pupils, the eyes are dull and heavy, and insensible to light. The patient rolls his head, has subsultus or tremors, picks at bedclothes, and occasionally utters shrieks or cries. The trunk is hot, the extremities cold, and the surface dusky. The sphincters also relax; there may be incontinence of urine or fæces. Death occurs from coma or from convulsions. It has often been noticed that patients, towards the beginning of the third stage, wake up, as if recovering; but such amendments are delusive, and in a day or two all the symptoms recur with increased severity. In tubercular meningitis in children, the ophthalmoscope discloses recognisable changes in the fundus oculi in 80 per cent. of cases. There is hyperæmia of the optic disc, disproportion between the veins and arteries, and darkening with distension of the retinal veins. In advanced cases, the ophthalmoscope further reveals neuro-retinitis; a degree of swelling affecting the margin of the discs and adjacent retina, and occasionally patches of hæmorrhage from rupture of the retinal veins. In these cases, the meningitis is supposed to be seated chiefly about the optic commissure.

Pathognomonic symptoms.—Before the first stage is established the child is fretful and wastes; there is loss of appetite and constipation, with retracted abdomen. *First stage.*—There is fever, but the temperature is not very high, the tongue is not much furred, there is violent headache, and sometimes delirium, or the delirium may be absent, owing to the basilar situation of the disease. There is great restlessness, contracted pupils, squinting, irregular respiration, and flushed face. *Second stage.*—No fever, commencing paralysis, sleepiness, a peculiar cry, and *tâche cérébrale.* *Third stage.*—Insensibility, dilated pupils, grinding of teeth, convulsions, slow pulse, cold skin, and paralysis. Where the surface of the brain is involved there may be delirium at first, gradually torpor, and finally coma. Also there may be convulsions or spasmodic contraction of muscles. Where the ventricles are distended with fluid there is profound coma; softening of the ganglia on either side may lead to hemiplegia. The implication of the cerebral nerves leads to strabismus and inequality of pupils; that of the pneumogastric to irregular respiration, to slow action of the heart, and disordered stomach.

Duration.—The disease lasts from eight to twenty-five days. Death is the most frequent termination. In some cases there may be only coma or drowsiness, and collapse a day or two previous to death. When tubercular meningitis occurs in adults there will probably be some history of acute tuberculosis or of chronic lung affection (pneumonic phthisis), which may seem to have subsided for a time. In these cases there are no premonitory symptoms. Meningitis sets in with convulsions or apoplexy, or with intense persistent headache, or with cerebral vomiting and fever, and contractions of the muscles of the nape of the neck. The patient likes to be left alone, is peevish and irritable, has a feeble, slow, and irregular pulse and dilated pupils. There is intolerance of light and sound. This stage is soon followed by mental depression, delirium, tonic or clonic spasms, stupor or coma, ending in paralysis and death.

Diagnosis.—Tubercular meningitis has been known to occur with such unexplained suddenness, and in several members of the same family at so short intervals, as to raise suspicion of death due to poisoning. Simple infantile convulsions often look very like cases of tubercular meningitis; a short delay in diagnosis will settle the question. The presence of squint will distinguish tubercular meningitis from mere convulsions. In an adult, tubercular meningitis giving rise to hemiplegia has been mistaken for a cerebral tumour, and, on the other hand, hemiplegia due to cerebral hæmorrhage, caused by violent coughing in whooping-cough, has caused the case to be mistaken for one of tubercular meningitis. No definite rules can be laid down for the distinction of cases of so much difficulty, and where no accurate history is obtainable it is best to suspend a conclusion for a time. The symptoms sometimes resemble those of typhoid fever, in which, however, there are usually relaxed bowels, tenderness and gurgling in the right iliac fossa, and distension and prominence of the abdomen. The tongue is also dry and the course of the temperature is peculiar.

Treatment.—As tubercular meningitis is almost invariably fatal, the treatment should be confined to such points as would be useful if the case were of a less serious character. Abstraction of blood and active purgatives do no good. Mercury in any form is harmful. Large doses of iodide of potassium have proved useful in a few cases. The headache and sleeplessness may be relieved by bromide of potassium. To allay restlessness and to relieve irritability very small doses of morphia (one twenty-fourth of a grain) may also be given with benefit. The bowels may be opened by an enema or by castor oil. The patient must be well supported and fed, and kept at rest in a quiet room, from which bright light is excluded. At the commencement, if the headache be very severe, a few leeches behind the ears will suffice; cold douche to the head has a palliative effect, but must be used with caution. Counter-irritation, in the shape of blisters behind the ears, sometimes gives relief. Sinapisms to the calves and to the feet are useful aids. Obstinate constipation can best be overcome or relieved by jalap and scammony. The tinctures of gelseminum and scutellarin, as nerve-depressants and sedatives, are of marked value in relieving restlessness and subduing convulsions. These act by soothing the nervous excitement and causing diaphoresis and diuresis. For children five or six years old a drop dose of each may be given every two hours.

The prophylactic treatment of children predisposed to acute hydrocephalus is all-important. Every attempt should be made to place them under the most favourable hygienic conditions. The food, the clothing, the exercise are points which deserve special attention. Sea-air is always beneficial, and cod-liver oil may be given as a food in cases in which there are indications of malnutrition. The child should not be sent to school, his lessons should be of a very easy description and for short periods at a time. Healthy exercise in the open air should be obtained whenever possible. If there be any evidences of anæmia, the syrup of the phosphate or of the iodide of iron may be added to the cod-liver oil.

EPIDEMIC CEREBRO-SPINAL MENINGITIS (CEREBRO-SPINAL FEVER).

Cerebro-spinal meningitis is a disease which occurs in an epidemic form. In its general course it resembles a specific fever, and it is probably due to the infection of the body by a specific poison. Like miasmatic disease it travels from place to place. It is probably never transferred by contagion. The infection gives rise to local disease, which consists of an inflammation of the membranes, and sometimes of the substance of the brain and spinal cord, and is manifested by various injurious effects on the body. The constitutional fever depends not upon the reception of the poison into the blood, but upon the local mischief. The disease is characterised by a peculiar malignant petechial eruption of a purpuric character, and is attended with painful contraction of the muscles of the neck. In some epidemics secondary effusion in certain joints has been noticed. The inflammation mainly involves the pia mater and the arachnoid. The dura mater, as in all forms of meningitis not due to injury, is less affected.

Causes.—The disease attacks young children and persons of middle age, and males more frequently than females. It is more common during the winter than in the summer. Its occurrence is favoured by overcrowding and bad hygienic influences. It has been observed in various parts of Europe, and likewise in America. The exact nature of the disease is still undetermined.

Morbid anatomy.—The body is not emaciated. The rigor mortis lasts for a long time. There is also extensive post-mortem congestion of the most dependent parts. On opening the skull, fluid or slightly coagulated blood escapes. The dura mater is tense, opaque, and here and there covered with hæmorrhagic deposits. The arachnoid cavity contains a few flakes of sero-purulent exudation. Effusion of soft lymph is also found in the fissure of Sylvius, round the pons, and at the base of the cerebrum and cerebellum. The brain is vascular, soft, and pulpy, even in the neighbourhood of the ventricles, which contain fluid of a semi-purulent character. The convolutions are generally flattened. No tubercles are deposited in any part of the brain. *Spine.*—The dura mater, especially at the lower part, is tense and vascular. There is rarely purulent fluid between it and the arachnoid. The arachnoid is decidedly opaque. The pia mater a little below the foramen magnum, and also in the lumbar region, is infiltrated with sero-purulent exudation. The cord is more or less vascular in certain parts, and sometimes infiltrated. The muscles are either dark or pale, and the body is covered with the remains of scattered vesicles (herpes).

Symptoms.—The symptoms are due to changes in the meninges of the brain and spine. They are somewhat similar to those of tubercular meningitis, already described. They may be preceded by slight headache and pain in the back. The disease is often ushered in by chilliness or actual shiverings, by giddiness, by very severe pain and tenderness in the head, nausea, and irrepressible vomiting. These symptoms are often associated with restlessness, contracted pupils, slow pulse, slight elevation of temperature, and frequent respiration. In a day or two other symptoms follow; the head is drawn backwards, and herpetic eruptions appear on the lips and other parts. A petechial eruption appears on neck, breast, or limbs; sometimes erythematous or roseolous patches appear on different parts. On the third or fourth day delirium follows, or tetanic spasms and convulsions occur, and there is hyperæsthesia of the whole body. There are sharp spasmodic pains, and stiffness in the muscles of the back of the neck (cervical opisthotonos), with marked sensitiveness of the spine and limbs, and there may be loss of sight and hearing, and finally of consciousness. Constipation is present, and the urine is passed involuntarily or there is retention. The abdomen is retracted. As the case progresses the headache becomes more severe; the neuralgic pain and tenderness in the head make the patient cry out suddenly from time to time. The pulse and respiration become more frequent. The skin of the body becomes of a high temperature, and is sometimes dry, sometimes moist. The patient falls into deep stupor. The face soon becomes pinched, anxious, and distressed; the pulse is frequent and feeble, and the temperature seldom or never rises above 105°, and in those cases in which collapse occurs it often falls below the normal; the head is drawn backwards by the arching of the neck, and is fixed rigidly; deglutition is difficult, and spasmodic convulsions often occur. The respirations in severe cases become embarrassed, hurried, or shallow. Delirium, which may set in late or early, is wild and maniacal; the eyes are bloodshot, and the pupils are irregular and contracted; the tongue is clean or brown and dry; the teeth and gums are covered with sordes. Severe gastralgia is not uncommon. Violent sickness occurs during the early period, often coming without nausea and without provocation from food. The urine sometimes contains albumen and blood.

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Termination.—Recovery is very rare, and when it occurs it is extremely slow. In unfavorable cases the patient soon becomes unconscious, and falls into a heavy stupor; there is loss of power over the limbs, tremulousness, imperfect vision, and involuntary discharges. The respiration also becomes embarrassed owing to œdema of the lung, and prostration is extreme. Death may occur within a few hours, or after some days. Relapses are very common. The first four days are most dangerous. When recovery takes place, the mind becomes clearer, and the pains in the head and neck are less severe.

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Prognosis very unfavorable. Life is rarely prolonged beyond the fourth day. In malignant cases consciousness is lost even on the first day. Severe spasms of the muscles of the back and neck may end the scene in twenty-four or forty-eight hours.

Treatment.—The disease is characterised by asthenia, and, therefore, severe antiphlogistics do harm. Leeches behind the ear and calomel internally may be prescribed. The local application of ice relieves the headache and pain in the neck.

The hypodermic injection of morphia and atropine sometimes palliates the symptoms so decidedly as to give rise to hopes of recovery. Quinine internally has been tried without any success. The urgent symptoms may be treated on general principles. Food should be nutritious and liquid, and stimulants should be avoided or used with caution. If nothing can be retained by the mouth nutrient enemata may be tried. Ergot and bromide of potassium are used to relieve cerebral congestion, which is often a prominent symptom.

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The prophylactic treatment of children predisposed to acute hydrocephalus is all-important. Every attempt should be made to place them under the most favourable hygienic conditions. The food, the clothing, the exercise are points which deserve special attention. Sea-air is always beneficial, and cod-liver oil may be given as a food in cases in which there are indications of malnutrition. The child should not be sent to school, his lessons should be of a very easy description and for short periods at a time. Healthy exercise in the open air should be obtained whenever possible. If there be any evidences of anæmia, the syrup of the phosphate or of the iodide of iron may be added to the cod-liver oil.

EPIDEMIC CEREBRO-SPINAL MENINGITIS (CEREBRO-SPINAL FEVER).

Cerebro-spinal meningitis is a disease which occurs in an epidemic form. In its general course it resembles a specific fever, and it is probably due to the infection of the body by a specific poison. Like miasmatic disease it travels from place to place. It is probably never transferred by contagion. The infection gives rise to local disease, which consists of an inflammation of the membranes, and sometimes of the substance of the brain and spinal cord, and is manifested by various injurious effects on the body. The constitutional fever depends not upon the reception of the poison into the blood, but upon the local mischief. The disease is characterised by a peculiar malignant petechial eruption of a purpuric character, and is attended with painful contraction of the muscles of the neck. In some epidemics secondary effusion in certain joints has been noticed. The inflammation mainly involves the pia mater and the arachnoid. The dura mater, as in all forms of meningitis not due to injury, is less affected.

Causes.—The disease attacks young children and persons of middle age, and males more frequently than females. It is more common during the winter than in the summer. Its occurrence is favoured by overcrowding and bad hygienic influences. It has been observed in various parts of Europe, and likewise in America. The exact nature of the disease is still undetermined.

Morbid anatomy.—The body is not emaciated. The rigor mortis lasts for a long time. There is also extensive post-mortem congestion of the most dependent parts. On opening the skull, fluid or slightly coagulated blood escapes. The dura mater is tense, opaque, and here and there covered with hæmorrhagic deposits. The arachnoid cavity contains a few flakes of sero-purulent exudation. Effusion of soft lymph is also found in the fissure of Sylvius, round the pons, and at the base of the cerebrum and cerebellum. The brain is vascular, soft, and pulpy, even in the neighbourhood of the ventricles, which contain fluid of a semi-purulent character. The convolutions are generally flattened. No tubercles are deposited in any part of the brain. *Spine.*—The dura mater, especially at the lower part, is tense and vascular. There is rarely purulent fluid between it and the arachnoid. The arachnoid is decidedly opaque. The pia mater a little below the foramen magnum, and also in the lumbar region, is infiltrated with sero-purulent exudation. The cord is more or less vascular in certain parts, and sometimes infiltrated. The muscles are either dark or pale, and the body is covered with the remains of scattered vesicles (herpes).

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Causes.—Encephalitis is not induced by causes which usually excite inflammation in other organs. It sometimes occurs in the course of acute and chronic infectious diseases, as pyæmia, glanders, typhus fever, measles, or scarlatina, and it may follow exposure to the sun (sunstroke). It also occurs in persons who drink spirits continuously for days or for weeks. Circumscribed encephalitis ending in abscess is generally due to direct injury of the skull, as fractures or wounds, involving the substance of the brain. In most cases of injury, however, it is due to extension of the inflammation from the membranes or from the bones of the skull. Chronic inflammation of the cranial bones, especially of the petrous portion of the temporal bone, is a frequent cause of encephalitis and suppuration within the cranium. The same lesions are sometimes due to the lodgment of foreign bodies, as bullets and pieces of metal, which have perforated the bones. Encephalitis may also arise from the presence within the brain of other foreign bodies, as a clot or morbid growths. In children it has been known to occur from fright. Diseases of the bones of the nose or orbit are an occasional cause.

Post-mortem appearances.—In most cases the inflammation is limited in extent. It may occupy a spot half-an-inch thick, or one measuring two or three inches. Ordinarily it is limited to one spot, but it may involve two or more. It may affect the cerebrum or the cerebellum. It is sometimes limited to the grey matter, sometimes to portions of the white, and sometimes affects both. It is often associated with inflammation of the membranes. There is more or less vascularity of the membranes and substance of the brain; the membranes are of a bright or deep red colour, often opaque, and there is fluid (serum, lymph, or pus) in the meshes of the pia mater and beneath the arachnoid. The brain-substance is found infiltrated, swollen, and soft, and its specific gravity is increased. On section of the affected part minute red clots are seen generally in the cortical portion, which is soft and firmly adherent to the arachnoid. In some places, when an incision is made, the inflamed part rises above the level of the incised surface. If the inflammation be of long standing the affected part assumes a dusky red hue, and there may be exudation of pus in the form of abscess in one of the cerebral hemispheres. In consequence of the pressure the convolutions are sometimes slightly flattened, and the brain-substance in the course of time becomes of a yellowish or rusty-brown colour. The ventricles are apt to be distended with fluid, and their whole surface is granular. The substance of the brain shows degenerative changes. In some cases the white matter is free from any morbid change, whereas the cortical portion shows increase of neuroglia and a diminution in the number of nerve-cells. In other cases the brain-substance assumes the consistence of thick cream, and can be readily washed away by a gentle stream of water. Under the microscope this pulp is found to consist of nerve-filaments, granular matter, blood-corpuscles, and masses of detritus. There is also serous effusion into the subarachnoid space. If suppuration occurs as a result of the encephalitis other changes take place. The abscess is surrounded by still solid but easily lacerable tissue, and contains fetid, thick yellowish matter. In the vicinity of the abscess there is inflammatory softening, and around it the brain-substance is œdematous. The abscesses are mostly single, unless due to pyæmia, when they are many in number. When single the abscess is usually seated in the white substance in the centre of the hemisphere. Its shape is round or oval; its wall is ragged or composed of a fibro-cellular capsule lined by a serous membrane. Abscesses generally begin after injury to the head, and they are sometimes consequent upon disease of the ear or nose, their chief seat being the middle cerebral lobe, rarely the pons Varolii. They may reach the surface, or may burst into a ventricle; on the other hand, their contents may be partially absorbed and the remainder be converted into a caseous mass. If inflammation be the result of some violence, the dura mater and the other membranes are thickened, and there may be a deposit of false membrane between the dura mater and the bone. Where the inflammation is diffuse over the whole brain there is extensive inflammation of the superficial grey matter, which is red, soft, and adherent to the pia mater.

Symptoms.—Acute general inflammation is very rare; the affection is almost always limited to certain parts. The symptoms are in part the immediate result of destruction of that portion of the brain which is involved, and are partly due to the disturbance of the cerebral circulation in the vicinity of the diseased area. Large portions of the brain may be destroyed, and even abscesses may exist for long periods during life without producing [illegible] disturbances. The symptoms [illegible] those of other cerebral affections. [illegible] stage of [illegible] [illegible] abeyance; [illegible] the first stage [illegible] intolerance of [illegible] and vomiting. The head is hot, and is the seat of a dull, heavy, and continuous pain, which is increased by noise or any exertion; there is also flushed face, irritable and fretful expression betokening suffering, and a desire to be left alone. The patient, if a child, resents being touched; there is grinding of the teeth; the eyes are often injected, and the pupils are contracted. The sense of hearing is slightly impaired; there is at first an increase, and afterwards decrease, of general sensibility. The patient frowns and screams at intervals, is fretful, and rolls the head about. Mental disturbances, indicated by violent or low muttering delirium, are a frequent symptom. Added to these are others, which depend upon hyperæmia and œdema in the neighbourhood. In advanced cases the pain, fever, delirium, and convulsions subside. These represent the formation of abscesses. After the abscess has formed there is hemiplegia or paralysis of one or other side of the body. Drowsiness or coma sets in if the abscess opens into the ventricles or on the surface of the brain.

Pathognomonic symptoms.—1. The pupils are contracted at the commencement; later on they may become unequal, and in the state of coma they are widely dilated and insensible to light. 2. The pulse is at first hard and slow or frequent, sometimes regular; later on it is extremely rapid and feeble. 3. The respirations are hurried, irregular, and sighing. 4. There is slight fever, but the temperature is seldom above 101°. 5. The skin is dry and somewhat branny. 6. The abdomen is retracted and hollow; its muscles rigidly contract on palpation. 7. There is either retention or dribbling of urine. 8. Sickness or vomiting after food is most common in the early stage. It is attended with little or no nausea, and continues even after the stomach is empty, and it is excited by the least movement; after vomiting the patient asks for food. This symptom can sometimes be allayed by counter-irritation at the back of the neck. The tongue is clean, the breath is sweet. The bowels are very much constipated. In some cases the control over the sphincter is lost. The appetite is generally bad, but sometimes ravenous. The patient wastes rapidly. The complaint sets in in various forms. In the most common form, where the inflammation is idiopathic, the symptoms begin with headache and vomiting, with frequent and hard pulse, sighing respiration, obstinate constipation, followed by delirium ending in coma.

Where the inflammation is due to the presence of clots, or softening, or a tumour, the patient suffers from persistent severe headache, and sometimes from opisthotonos. There may be paralysis, followed by a slight accession of fever, with headache or giddiness, impairment of memory or intellect, and delirium, convulsions, or coma; or there may be rigid flexion of the already paralysed limbs, or hyperæsthesia, or pain in the paralysed muscles and joints, and a tendency to the rapid formation of bedsores. In other forms of encephalitis the convulsions are severe, and come on suddenly. The patient falls down suddenly and gets up again quickly; there is no loss of consciousness nor any subsequent discomfort, but after a time paralysis, with loss of speech, sets in. This is followed by rigidity, complete hemiplegia, or contraction of the limbs. In other cases convulsions are followed by coma, ending in death in a few hours, or the convulsions may recur frequently at short intervals, and, after a period varying from one to two days, collapse sets in. The patient is in a state of stupor, his voice sinks into a whisper and becomes indistinct; sometimes the patient is speechless, vision and hearing are much impaired, the pupils are quite dilated, and muscular twitchings occur. This soon passes into a low adynamic condition, the body being covered with cold sweats. There is involuntary passage of urine and fæces, a few convulsive fits precede coma, and death occurs.

Where inflammation runs on to suppuration or to softening, all the symptoms are aggravated. There is increased weakness and fever, with rigors, cerebral vomiting, and constipation, and dull headache at one fixed spot, giddiness, delirium, dulness of intellect, increased apathy, coma, or convulsions, or paralysis of special senses, or of speech, and want of control over the bladder and rectum. Where the abscess is encysted, the disease may continue latent for months without any manifest symptoms of its presence.

In abscess the symptoms vary with its size, position, and the diseases with which it is associated, as pyæmia, otitis interna, erysipelas, &c. Thus, if pyæmia exist, the fever will be high, and attended with rigors, but should the abscess be encysted, there will be little or no fever. Pain is another symptom of cerebral abscess, and when coexistent with disease of the bones or of the dura mater, it is most marked, and often referred to a particular spot, as the eyes, temples, or back of the head. If the abscess be so situated as to destroy the sensory centres, or to interrupt the conduction of the impulse of the will to the motor nerves, or of the impressions made on the organs of special sense, there will be more or less anæsthesia or paralysis of the implicated parts or organs. A large abscess causes hemiplegia on the opposite side of the body. When the pons Varolii is affected, there is turning of the head and conjugate deviation of the eyes towards the paralysed side. If the abscess be in the medulla oblongata, there will be paralysis of spinal nerves, and respiration and deglutition will become affected. It should be borne in mind that a few cases are on record in which the symptoms were altogether obscure.

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In abscess the symptoms vary with its size, position, and the diseases with which it is associated, as pyæmia, otitis interna, erysipelas, &c. Thus, if pyæmia exist, the fever will be high, and attended with rigors, but should the abscess be encysted, there will be little or no fever. Pain is another symptom of cerebral abscess, and when coexistent with disease of the bones or of the dura mater, it is most marked, and often referred to a particular spot, as the eyes, temples, or back of the head. If the abscess be so situated as to destroy the sensory centres, or to interrupt the conduction of the impulse of the will to the motor nerves, or of the impressions made on the organs of special sense, there will be more or less anæsthesia or paralysis of the implicated parts or organs. A large abscess causes hemiplegia on the opposite side of the body. When the pons Varolii is affected, there is turning of the head and conjugate deviation of the eyes towards the paralysed side. If the abscess be in the medulla oblongata, there will be paralysis of spinal nerves, and respiration and deglutition will become affected. It should be borne in mind that a few cases are on record in which the symptoms were altogether obscure.

Duration.—Death may occur as early as the fifth or sixth day, or as late as the fourth week. It is preceded by coma, or it may be due to asphyxia or to asthenia.

Treatment.—The disease is not generally diagnosed until irreparable destruction has occurred in the brain. Where encephalitis is due to injury we have to adhere strictly to an antiphlogistic regimen; the diet should be low; purgatives, digitalis, and antimony may be given. The head should be shaved and ice constantly applied. Leeches to the temples or bleeding from the arm are likely to be of use only when the symptoms are very acute. Where there is much excitement, morphia may be injected under the skin. Perfect quiet, in a cool darkened room, is of course necessary. Intracranial suppuration, left to itself, is almost necessarily fatal, and it is very difficult to distinguish between the symptoms of local pressure on the surface of the brain, as from a limited collection of pus above the dura mater, or an abscess encysted in the arachnoid, and the symptoms of general pressure produced by an extensive accumulation of pus on the surface of the brain, or in the substance or ventricles of the organ. The question of trephining occurs when the symptoms of suppuration are followed by those of compression of the brain, and it is necessary to determine, as accurately as possible, the seat of the lesion. In traumatic cases, when the suppuration is either above the dura mater or amongst the membranes, we notice the so-called "puffy tumour" on the surface, due to effusion between the bone and the periosteum, muscular spasms, and unilateral hemiplegia, and these symptoms occur at an early period, generally during the first fortnight. When the lesion is in the substance of the brain, the symptoms are much later in their development, and the coma and paralysis are less complete. Injuries and lesions of the lower and back part of the brain give rise to more serious symptoms than lesions of the upper and anterior parts of the organ. An encysted abscess (due to injury) of the frontal lobe on one side has been known to remain latent for nearly a year, the patient going about his usual avocations. When the walls of the abscess gave way, death occurred suddenly, the pus reaching the base of the brain.

CHRONIC ENCEPHALITIS—SCLEROSIS.

Sclerosis is due to a chronic process, probably of inflammatory origin, which involves both the membranes and the brain. It is marked by a slow development or increase of connective tissue among the essential brain-elements, and is followed by gradual degeneration and wasting of these tissues.

Post-mortem appearances.—On opening the skull the dura mater is adherent to the bones, the arachnoid is thick and opaque in parts, the pia mater is adherent to the brain and highly vascular, and the membranes are also adherent to one another. There is fluid in the subarachnoid space and in the meshes of the pia mater, and also in the ventricles; the Pacchionian bodies are increased in size. There is at first an overgrowth of the neuroglia, by the deposit in it of newly-formed cells, and also by the increase of the intercellular substance. The nerve-cells are diminished in number. As the case progresses, the new tissue contracts and hardens. Newly developed leucocytes are found in the sheath of the blood-vessels, which, by being compressed, become narrowed and thick-walled. The nerve-tubules and nerve-cells are widely separated by these adventitious growths, the white substance of Schwann which these tubes contain disappears, and the tubes therefore become thin. In far advanced cases the tubules are greatly atrophied, and even, in rare cases, destroyed. The portions of the sclerosed brain appear in the form of nodules or rough spots, which are tough and indurated. When cut into, they appear milk-white and bloodless; and, if exposed for a while, the cut surface becomes depressed and covered with a little serum. If the spot be superficial, it is adherent to the pia mater. The disease has a tendency to be limited to certain tracts or nerve-centres. It is more often found in the white than in the grey substance. The number of nodules varies: sometimes they are solitary, but it very often happens that the sclerosed patches are numerous, and scattered irregularly throughout the nerve-centres—a condition known as multiple or disseminated sclerosis. In this last form the patches appear in the cerebrum, cerebellum, pons, medulla, and even in the cord. Under the microscope we find amorphous granular masses and nerve-elements. These latter are wanting in the centres of the nodules, which consist of filamentary masses, remains of capillaries, and fatty débris.

Causes.—Diffuse sclerosis, or sclerosis of the whole encephalon, is a disease of early life; it is most common between twenty and twenty-five, and is rarely seen after thirty years. It is more common in women than in men, and is sometimes attributable to previous injury to the skull, chronic alcoholism, irritation of some morbid deposit, inherited syphilis, great mental exertion, and exposure to wet and cold.

Symptoms.—They are allied to those which mark the commencement of insanity. The most characteristic symptom is paralysis of single groups of muscles, or of one lower extremity, the paralysis extending in an irregular manner to other parts. There is also either great mental excitement or depression, more or less constant, *Duration.*—Death may occur as early as the fifth or sixth day, or as late as the fourth week. It is preceded by coma, or it may be due to asphyxia or to asthenia.

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Symptoms.—They are allied to those which mark the commencement of insanity. The most characteristic symptom is paralysis of single groups of muscles, or of one lower extremity, the paralysis extending in an irregular manner to other parts. There is also either great mental excitement or depression, more or less constant, or general headache, vertigo, peevishness, restlessness, irritability, trembling, and want of sleep. As the case progresses, there is failure of the intellect, difficulty of speaking, slow and drawling utterance, and the patient becomes low-spirited, apprehensive, and demented, the memory fails, some of the external senses are impaired, there is tendency to stupor, general paralysis sometimes sets in, and the health completely breaks down. Vertigo is very often complained of. Tremors are caused by any muscular effort, and are increased by attempts to restrain them. The mind becomes dull, energy and vitality are lost, speech is indistinct, and the disease ends gradually in fatal exhaustion. In some cases irregular epileptiform convulsions occur, which are not followed by coma.

Treatment.—All we can do is to support the general health of the patient by judicious hygienic measures. Milk, beef-tea, and liquid nutritious food are essential. To promote absorption, repeated blisters to the neck, a seton, or an issue, or inunctions of mercurial ointment, and iodide of potassium internally, may be tried. The state of the bowels should be attended to. Strychnia and nitrate of silver, arsenic, belladonna, ergot of rye, and bromide of potassium, have been tried without obvious good. The disease invariably proceeds from bad to worse; it may last five or six years. Relief to the more severe symptoms is all that can be expected from treatment. If there be any history of inherited syphilis, any account of "snuffles" when young, iodide of potassium should be given in large doses.

Morbid Growths of the Brain and its Membranes.

These adventitious growths, or neoplasms, are of various kinds. Some of them are occasionally observed after injuries to the head. Miliary tubercles of the pia mater have already been described in the chapter on "Tubercular meningitis." Another variety of tubercles is sometimes found within the brain-substance. These are irregularly rounded, yellowish masses, of a caseous appearance, or dry and bloodless, and continuous with the brain-substance, or more or less isolated by connective tissue. They are rarely primary, but generally follow tubercles in the lymphatic glands or the lungs. They are made up of an aggregation of smaller masses, may be solitary or in groups, and are found in the grey matter of the cerebrum, cerebellum, and cord. They also invade the pons, the medulla oblongata, the optic thalami, and corpora striata. In size they vary from that of a mustard seed to that of a walnut, and in rare cases are much larger. They are soft in the centre, and often contain cavities. They are more common in boys than in girls, and seldom exist before two years or after seven.

Syphilitic growths.—These sometimes occur in the dura mater, and they are often associated with disease of the cranial bones. They affect the brain by pressure. Similar growths are also found in the arachnoid and pia mater, and even in the substance of the brain. In structure and appearance they resemble the gummata found in other organs. They are of a greyish-red colour and extremely vascular, and either soft and slightly fibrous, or hard and firm ; this difference being due to the varying proportions of cells and fibres. At a later stage, the growths on section look yellowish, and are of cheesy consistence. Syphilitic disease has a tendency to affect the parts at the base of the brain, and consequently to involve nerves.

Syphilis also causes obstructions of the cerebral arteries by thrombi, and thickening and induration of their walls, so that the canals of the vessels are subsequently occluded. These changes sometimes occur as early as the sixth month after infection.

Syphilitic arteritis has been described by Heubner as altogether special and characteristic. The following is a *résumé* of its pathology : —At the commencement there is observed, on the internal surface of the artery, a formation of new endothelial cells, which are arranged in superimposed layers, some flattened, others fusiform or round. This proliferation fills the openings and depressions in the fenestrated membrane in such a manner that the surface of the artery becomes smooth and regular instead of being uneven. As a result the fenestrated membrane, which in its normal condition is, in the arterioles of the brain, in immediate contact with the endothelium, is separated from it by a layer of newly-formed cells. The process begins at the internal surface of the vessel, and is due to the direct and irritating action of the syphilitic blood. The zone of proliferation, by increasing the thickness of the internal membrane of the artery, reduces its calibre, or at least diminishes its dilatability and elasticity under the influence of the blood. Inflammation going on, the endothelial layer is raised up at one point by the multiplication of the cells, and forms a lateral projecting vegetation into the lumen of the vessel, which, by reducing the calibre of the vessel, may be the starting-point of a thrombosis, or at least of a cerebral ischæmia. These peculiarities, especially the formation of a single lateral projection upon the internal membrane, are believed to be characteristic of syphilitic arteritis.

These changes occur with great rapidity, and reach their maximum in the space of a few months. They sometimes remain stationary for several years. Fatty degeneration, so common in atheroma and in chronic senile arteritis, is not observed in syphilis. The morbid process in the latter complaint causes narrowing of the artery; in atheroma the vessel is widened very early. Atheroma, moreover, occurs in old subjects, and has no special preference for the cerebral vessels, but is more common in the aorta and the large arteries. In syphilitic arteritis, which is also a more rapid process, the cerebral arteries are chiefly affected, and the patients are mostly young. Cerebral softening is the important consequence of this arterial lesion. It is most frequently seen in the parts of the brain supplied by the middle and posterior cerebral arteries. The arteritis is sometimes associated with the formation of gummata.

Myxomata.—These consist of mucous tissue, and are found in the medullary substance of the brain. They are somewhat translucent, and of a faint yellow or red colour. They appear either as circumscribed tumours or as a gelatinous infiltration.

Glioma is a tumour formed of delicate fibres originating in the neuroglia or the connective tissue of the brain; the nerve elements are destroyed. Glioma is peculiar to the nerve-centres, the cranial nerves, and the retina, and is greyish or pinkish-red in colour.

There are two forms—hard and soft; the hard is difficult to distinguish from the nodules of sclerosis; the soft is always very vascular, and consists of roundish nuclei. The growth is inseparable from the brain-substance. Such tumours are of slow growth, and often attain a large size. They occur chiefly in young persons. Small hæmorrhages often take place into their structure, and the growths sometimes become caseous.

Sarcomatous growths occur in the medullary substance of the cerebrum; they are often attached to the meninges (dura mater), and are of two kinds—hard and soft. The soft is white or grey, vascular, and resembling brain-substance; the hard variety resembles fibroma. When situated at the base of the brain they attain a large size. They form rounded or lobulated tumours, sometimes as large as an orange. When cut the surface is smooth and dirty white or reddish in colour. Under the microscope the tumour is found to be made up of spindle-shaped cells arranged in bundles. They are surrounded and isolated by a vascular covering, from which they can be removed. They often contain carbonate of lime. These calcareous particles sometimes make up the bulk of tumours found in the membranes of the brain and the choroid plexus, and such growths have been called *psammoma*, or sand-tumours.

Carcinoma.—Carcinoma sometimes exists in advanced age, but rarely as a primary affection, in the brain or cord. It is usually secondary to carcinoma of other organs. The scirrhous, the encephaloid, and the melanotic varieties sometimes invade the brain, the bones, and the membranes. The encephaloid is the most common, and takes the form of a soft, rounded, or lobulated mass. It may be developed originally in the external soft parts of the skull, and thence spread to the brain. The tumour has no distinct boundaries, and thus differs from sarcoma. It has a tendency to extend, and especially along the bony canals through which nerves pass. Cancers of the brain may attain a large size; they never suppurate, but may undergo retrogressive changes, and become yellow and cheesy and shrink in the middle; they are usually single, but sometimes there are two tumours, one on each side of the brain.

Among the parasites the *Cysticercus cellulosæ* and *echinococci* are occasionally found in the brain. The former is the larva of the *Tænia solium*. It is an oval body, 10 mm. long, with four suckers and twenty-six booklets in two rows round the mouth. They occur generally in the grey substance. Echinococci are much more rarely found in the brain. They form, as elsewhere, large vesicles, enclosed by a very delicate germinal membrane. When they do exist, they may remain latent for some time without producing any inflammatory changes.

Aneurisms of the cerebral arteries rarely occur, but they have been sometimes observed on the exterior of the brain, and occasionally in its substance. They are generally due to degeneration of the arterial walls from endarteritis deformans. When small and numerous they are called miliary aneurisms. When in large vessels they cause apoplexy. They implicate the internal carotid, the basilar, the middle meningeal, the anterior and middle cerebral arteries, and the arteries of the circle of Willis. They vary in size from that of a pea to that of a small nut. They sometimes cause compression of the nerves at the base of the brain.

Symptoms.—These are similar to those met with in other local diseases of the brain, such as cerebral hæmorrhage, partial hyperæmia, partial anæmia or softening, partial encephalitis, &c. Thus the symptoms refer to destruction of a limited portion of the brain, and they also depend on the mechanical effects of the tumour, or its encroachment on the intracranial space, and on derangements of the circulation in the vicinity of the diseased part. Other symptoms are due to softening or chronic inflammation, which the tumour sets up after a time. Besides the symptoms due to causes just referred to, and which are also common to abscess and other local diseases of the brain, there are a few others which are more or less distinctive of the presence of a cerebral tumour. These have reference partly to the history of the case, partly to the situation of the growth in places where abscess or hæmorrhagic clots are rarely found, and partly to a peculiar course or progress of the tumour.

Where the patient has had no injury to the head, and there is no caries of the petrous bone, no organic heart-disease, no degeneration of the arteries, and the existing symptoms point to local cerebral disease, tumour may be suspected. Very often tumours attain a large size, and remain latent throughout, without giving any definite symptoms of their presence. Such growths are situated in the medullary masses of the cerebrum, and do not affect any central nerve-ganglia. These latent tumours are generally of slow growth, and non-vascular.

Local symptoms.—There are partial paralysis and anæsthesia. Other symptoms are due to the congestion of the vessels caused by the pressure of the growth, or, as in aneurisms, to hæmorrhage, or to sudden apoplectic fits. The earliest, and often for some time the only symptom, is headache, which is severe and unusually intense, and sometimes localised. It is accompanied with cerebral vomiting, giddiness, and impairment of special senses. The headache, though common in various brain-diseases, has never such marked characters. After a time it becomes paroxysmal. Where the headache is confined to the back of the head, the tumour is generally situated in the posterior cranial fossa, and it presses on the tentorium. Among the other local symptoms, there are those due to partial irritation, as hyperæsthesia, neuralgia, formication, twitchings, &c. These generally precede partial anæsthesia and partial paralysis. All these local symptoms are characteristic of a cerebral tumour, and are more frequently observed in the parts supplied by the cerebral nerves than in those connected with the cerebro-spinal system. In other local brain-diseases the morbid process is more often confined to the brain, and does not generally affect the nerves passing from it. In the case of tumours, the nerves are frequently implicated.

Paralysis.—In cerebral tumours the paralyses of cerebral nerves are peripheral; in other forms of brain-diseases they are always of a central origin. Exception to this is met with in the facial paralysis, which is also of central origin, and which, as a symptom of hemiplegia, occurs in cerebral tumours, as well as in other local cerebral diseases. If the tumour be at the base of the brain, the functions of the third, fourth, and fifth nerves are likely to be destroyed one after the other and in regular sequence, while amaurosis ensues from pressure on the optic nerve, or from venous congestion within the eyeball, the result of obstructed circulation. In other cases, the tumour implicates the eighth and ninth nerves, and leads to impairment of speech and deglutition. If the tumour is in the cerebrum, and chiefly near the surface of the hemispheres, epileptic convulsions unattended with loss of consciousness occur. When the tumour is in one side of the cerebrum, or in one side of the pons, or in one side of the cerebellum, or in one crus cerebri, hemiplegia sets in sooner or later. Hemiplegia due to cerebral tumour is characteristic, in so far that in tumour implicating one side of the cerebrum, there is paralysis only of one half of the body, and the other half is quite free. In tumour of one crus cerebri, there is paralysis of the opposite side, associated with paralysis of the oculo-motor nerve of the same side. In tumour affecting the lateral portion of the pons, there is paralysis or anæsthesia of the face of the same side, and also hemiplegia and anæsthesia of the opposite half of the body. If the tumour be in the cerebellum, besides hemiplegia, a peculiar staggering gait is seen. In such cases the hemiplegia is not constant. The peculiar gait is due to paresis of the muscles inducing bending, erection, and lateral movements of the spinal column. Tumours affecting both sides of the cerebrum, middle parts of the pons, and in the medulla, lead to paralysis of both sides.

Prominent symptoms.—These are headache, giddiness, sickness, convulsions, and amaurosis. Headache is a common symptom, and is often persistent and agonising; it is rarely absent; the patient sometimes feels as if the head would burst. It may affect especially the front or the back of the head, or be referred to the vertex. In some cases it shoots through the temples and involves the eyeballs. Vertigo is rarely absent, and is often the first and most constant symptom. Vomiting sometimes sets in from the first; it generally comes on without apparent cause, and is attended with nausea, loss of appetite, and constipation. Sometimes the organs of special sense, as the eye, ear, tongue, and nose become deranged in various degrees. Slow and irregular pulse is occasionally an early symptom of a tumour in the brain. Hemiplegia is absent at first, but may come on at a later stage of the disease. In some cases the growth of the tumour is the cause of apoplexy or an epileptic fit, or paroxysms of convulsions, and these are soon followed by hemiplegia. Local paralyses, as of the face, are often present in cases of tumour, as in other local cerebral diseases, and are associated with perverted sensibility. This local paralysis is due to the pressure of the tumour on the nuclei of origin of the affected nerves, or on some part of their trunks, or to the implication of their nuclei of origin in the morbid process. Paralysis sometimes involves the motor nerves of the eye, viz. the third or oculo-motor, the fourth or trochlear, and the sixth or abducent nerve, and hence in some cases we have single or double external strabismus, persistent dilatation of the pupil and accommodation of the eye for distant objects, and drooping of the upper eyelid. Paralysis of the sixth nerve causes diplopia and convergent strabismus. If the portio dura is affected the muscles of the face are paralysed. Paralysis of the hypoglossal and the glosso-pharyngeal is shown by disturbance of articulation and deglutition. In all these affections the state of the nerves and muscles under the action of electricity affords a certain means of distinguishing peripheral from central paralysis. In peripheral paralysis, which includes most paralyses due to a tumour, contractions of the muscles do not take place when an induced current is passed through the nerve, whereas in other forms of brain disease the mucles contract normally when the electricity is applied. The sensory nerves are also sometimes implicated; and the fifth occasionally suffers. In some cases the surface of the eyes becomes inflamed. In cases of tumours the paralysis is often preceded by twitching of muscles, as especially seen in the facial muscles before paralysis sets in. Similarly in paralysis of the oculo-motor, twitching of the muscles of the eyes is a precursory symptom. Sometimes the olfactory nerves are affected, and smell or taste is impaired or lost. Troublesome noises in the ears or even deafness are occasional symptoms.

The affections of the eye are most important and frequent in cerebral tumours. They may be due to pressure upon the optic nerves, the optic tract, or corpora quadrigemina. The disturbance may amount to obscurity of vision, double vision, amblyopia, or amaurosis of one or both eyes. The affection of the eye is also noticed in cases where the tumour exists in the posterior cranial fossa or in the cerebrum or the cerebellum, and therefore at a distance from the optic nerves. In such cases interference with the intra-ocular circulation is the chief factor in the causation of the symptoms. The ophthalmoscope affords great aid in the diagnosis of cerebral tumours. In cases of tumours encroaching on the cavity, the ophthalmoscope reveals swelling of the optic papilla and great tortuosity of the central vein. We also notice slight inflammation of the retina and atrophy of the optic nerve, as results of inflammation of the nerve and the pressure exercised by the tumours. All cerebral tumours are of slow growth, and all these local symptoms may come on at any period, and increase with the advance of the disease. In the later stages the symptoms become permanent.

Mental disorders.—Some of the indications of a cerebral tumour are: delirium, failure of or defective speech, loss of consciousness, followed by paralysis, or in some cases by epileptic or apoplectic convulsions. In a majority of cases the epileptic convulsions occur only at a later stage, and generally before death. Where delirium occurs with epileptiform convulsions the tumour is supposed to be located in the cerebrum, and chiefly near the cortical substance. Failure of memory and of control over the bladder and rectum is common in advanced cases. The nutrition of the body and its general condition are not affected till the tumour has lasted for some time. In a few cases marasmus sets in early, the patient becomes emaciated, and may be bedridden. Bed-sores rapidly form and cause severe suffering and want of sleep. Dropsy of the feet is common.

The symptoms connected with cerebral *syphilis* deserve special mention, principally because their successful treatment depends upon a recognition of their cause. Syphilis, it may be said, gives rise to no specially characteristic symptoms; but the manner in which these latter are often developed and are grouped together, subside and reappear, is, in the majority of cases, so peculiar as to be almost pathognomonic.

Syphilis gives rise to all kinds of disorders of sensibility, from slight pain to the most acute suffering, and from slight loss of sensation to the most profound anæsthesia. In like manner, cerebral lesions, due to this virus, give rise to motor disorders of the most varied kind—spasms, convulsions, rigidity, loss of power, and complete paralysis. Besides these sensory and motor symptoms, we find manifold psychical disturbances, such as sleeplessness, excitement, delirium, mania, coma, &c., and all degrees of mental debility, as regards the memory, the disposition, the will, and the understanding.

The most frequent signs of cerebral syphilis are headache, giddiness, faintness, and apoplectic attacks, associated with torpor and coma. Epilepsy is by no means rare. The speech is often affected, and in a peculiar manner. The patient loses a number of expressions, syllables and letters, and omits them in speaking and writing. Sometimes it is found that the patient can make use only of a few words or short sentences, and these are used on all occasions. In other cases, affixes and prefixes are added to words. In other cases, the speech is slow and stumbling, as if the flow of the thoughts were delayed.

A condition of listlessness, amounting to apathy, is not unfrequent. The patients refuse to leave their beds, even for the most necessary purposes. There is no paralysis of the sphincters, but the urine and fæces are allowed to pass in bed, or on the floor, without any sense of shame or discomfort. This symptom has been observed in a patient who, before the attack, was most fastidious and scrupulous in all his habits. Complete apathy seemed to possess him; he appeared to have lost all sense of cleanliness, of shame, and of duty.

In the majority of cases, the symptoms show a great tendency to subside and recur, and these alternations may take place repeatedly. Sometimes, however, the symptoms are marked from the first by severity and rapidity of increase. Sudden aphasia, epileptic fits, or stupor may come on and increase till death results; or while there is an improvement in regard to one symptom, others occur, indicating the existence of a rapidly spreading lesion, rather than of one for the most part localised, and involving severe destruction.

Terminations.—In the majority of cases of morbid growths, the disease sooner or later terminates fatally. In carcinoma, the ordinary duration is only a few months, but occasionally a year or more. Death is sometimes due to intercurrent disease or complication, or coma sets in and ends the scene. In other tumours, the duration varies from a few weeks to many years. Death occurs from bedsores, or from convulsions, or is ushered in by coma.

Diagnosis.—Tumours may be confounded with apoplectic effusions, emboli, abscess of the brain, and sclerosis. These all rank among local diseases of the brain, and are liable to cause swelling, inflammation, and softening. The determination of a tumour is best aided by the careful examination of the history of the case. In tumour there is no particular history of injury to the head, no caries of the petrous bone, no hypertrophy or other disease of the heart, and no degeneration of the arteries. A chronic course is observed only in cases where the tumours occupy parts of the brain where they do not disturb important nerve-centres or interrupt conduction. Age is often an indication of the nature of the tumour. Tubercles are limited to children. Syphilitic tumours occur in adults, and there would be a distinct history of syphilis or presence of nodes and other external manifestations. Sarcoma and glioma affect young adults, and carcinoma appears late in life. Malignant tumours are generally secondary, and the patient will exhibit indications of malignant disease elsewhere. Hydatids may be suspected if the patient be young, and have hydatids in other parts; also if there be absence of constitutional symptoms, and of indications of cerebral inflammation and softening. It is worth recollecting that though hydatids of the brain are so uncommon in man, they are of common occurrence in the lower animals, and are a frequent cause of death.

Treatment.—We can do but little if sarcoma or carcinoma exist. The chief indications are: to guard against hyperæmia of the brain, to regulate the bowels, and attend to other emunctory organs. If cerebral hæmorrhage sets it, venesection or local bleeding may be tried. Encephalitis may be combated by local bleeding, ice, and compresses to the head. All that can be done is to alleviate urgent symptoms. Thus, vomiting may be relieved by cooling drinks, and various other remedies already fully detailed. The pain in the head may be relieved by internal sedatives, as morphia, by cooling lotions and other local applications, and by leeches behind the ear. Cold compresses or sinapisms to the nape of the neck are efficient derivatives in such cases. Small doses of morphia often relieve headache, and may be given freely. If tubercles are suspected to be present, it must be borne in mind that they are generally of slow growth, and therefore treatment by cod-liver oil and other methods adapted for tuberculosis may be tried. Syphilitic tumours often improve under anti-syphilitic treatment; and as experience shows that many cases improve under similar measures, it is best to adopt them in suspicious cases. The anti-syphilitic treatment embraces mercurial inunctions or fumigations, and iodide of potassium, of which large doses, often as much as ʒij a day, may be given, frequently with the effect of relieving all the symptoms, and, in some cases, of inducing their complete disappearance. The influence of mercury and iodide of potassium over syphilitic cerebral affections is such, that if a patient be suffering from severe cerebral symptoms, his prospects of improvement and recovery are much greater if he is the subject of syphilis, than if he presents no history of that affection.

HYDROCEPHALUS.

Hydrocephalic effusions in the brain, or in connection with its membranes, do not occur as independent affections; they are, on the contrary, the results of morbid processes very varied in kind. In tubercular meningitis, it often happens that acute effusion takes place into the ventricles, and the so-called acute hydrocephalus is in reality due to the deposit of tubercles. Cases sometimes occur in children, in which the ventricles of the brain are filled with fluid, and their walls soft and diffluent, and although in these cases there is no sign of meningitis, this process may be supposed to have preceded the effusion.

Chronic hydrocephalus occurs in two forms; 1, in adults, in whom, ossification being complete, no further distension of the cranial cavity is possible. 2. In infants, either as a congenital condition, or supervening shortly after birth, great distension of the cavity of the skull being the result in either case.

1. HYDROCEPHALUS IN ADULTS.—Effusions sometimes take place into the ventricles, and between the membranes, in the course of certain diseases in which there is a general tendency to serous effusion. This is especially the case in Bright's disease of the

kidney, in which the tenuity of the blood-serum predisposes to transudations through the cerebral capillaries. Other causes are those which produce disturbance of the circulation with increased tension of the vessels of the brain. Among these may be mentioned, thrombosis of the cerebral veins and sinuses, and tumours in the posterior cerebral fossa, which prevent the escape of blood. Another cause of hydrocephalus is atrophy of the brain, which sometimes occurs in old people.

The effusion may take place either into the ventricles, or into the meshes of the pia mater and in the subarachnoid space. The infiltration generally extends over the whole brain, but it is sometimes more or less circumscribed, and gives rise to the appearance of small vesicles or bladders. Effusion into the ventricles is a more serious condition. When acute, the cavities become moderately distended, and contain a fluid which is either clear and transparent, or more or less opaque, owing to admixture of blood-corpuscles, epithelium and particles of tissue. The walls of the ventricles present various degrees of softening.

When the effusion is chronic in its course, the ventricles are considerably dilated. They contain a varying quantity of serum, sometimes eight ounces or more. The liquid is clear and contains but little albumen. It is seldom found in the third ventricle. The ependyma is thickened and often studded with tiny granulations. The walls of the ventricles are harder than normal, owing to the condensation of the brain-substance.

An effusion to any considerable extent encroaches seriously upon the cranial space, and prevents a due amount of arterial blood from circulating in the brain. It gives rise, therefore, to all those symptoms which have been described in the chapter on cerebral anæmia, viz. loss of consciousness and convulsions, and other symptoms of depression and irritation of the brain, with various forms of paralysis as further results. What has been termed "serous apoplexy" is due to sudden and profuse effusion of serum into the cerebral substance and the ventricles. The symptoms resemble those of apoplexy due to extravasation of blood, and the differential diagnosis may at first be very difficult to make. In children the symptoms of acute hydrocephalus resemble those of meningitis.

The symptoms of chronic hydrocephalus either follow those of the acute attack, or come on gradually and are milder in character. When the effusion is moderate in quantity and occurs slowly, the brain accommodates itself to the pressure, and no marked symptoms may be present. When, however, the limit of accommodation has been reached, certain symptoms, which are in no way characteristic, make their appearance. These are, a feeling of weight in the head, restlessness, sleeplessness, sensory disturbances, delirium or apathy, imbecility, weakness of the limbs, a staggering gait, difficulty of articulation, paresis of the facial muscles, ptosis, &c. The pulse is slow, and vomiting frequently occurs. The disease runs a chronic course, with manifold variations in the symptoms ; death is generally preceded by coma or stupor.

The treatment of acute hydrocephalus is the same with that of meningitis and acute congestion of the brain. That of chronic hydrocephalus resembles the measures to be adopted for the congenital form, next to be described.

2. CONGENITAL AND INFANTILE HYDROCEPHALUS.—The serous effusion takes place in the incomplete skull, either while the fontanelles are open, or before the cranial sutures have become completely ossified. In weakly children hydrocephalus may make its appearance some years after birth. In such cases the condition may be due to meningitis or disorders of the cerebral circulation caused by the presence of tumours, or to a general watery state of the blood. The causes of the development of hydrocephalus during fœtal life are very obscure, but it is probable that the effusion is due to inflammation of the ependyma of the ventricles. Drunkenness in one or both parents has been adduced as a cause; it sometimes happens that several hydrocephalic children are seen in the same family.

The ventricles are the ordinary seat of congenital hydrocephalus, and of that which occurs in early infancy. The cranium is more or less enlarged; it sometimes attains an enormous volume, it may measure as much as 25 inches in circumference. The bones at the base of the skull are not affected in this enlargement; those forming the roof are especially implicated, they are thin or even transparent; the fontanelles are very large; the forehead projects; the orbit is depressed and the eye half-concealed by the lower lid ; the squamous portion of the temporal and the occipital bone are pressed outwards. Ossification is delayed, the skull presents many irregularities of shape, and small bony islets are often found in connection with the sutures.

The fluid which is effused into the ventricles is clear and colourless, unless any inflammation exist, in which case it may contain blood. It is very slightly albuminous, but contains abundance of potash and phosphates. In quantity it has been known to reach five pounds and even more. In these extreme cases the cerebral substance bounding the ventricles is reduced to the thickness of a few lines only, the ganglia are much compressed, the crura cerebri widely separated and the septum between the ventricles almost or quite obliterated. The cerebellum, pons and medulla oblongata are but little affected. There are often signs of inflammation of the ependyma, which is thickened and dotted over with granulations. In those rare cases in which the skull is not enlarged in proportion to the quantity of the fluid, the pressure of the latter causes considerable atrophy of the brain. The fluid is sometimes found between the dura mater and the cranium, sometimes between the former membrane and the arachnoid, sometimes in the cavity of the latter and sometimes in the meshes of the pia mater. The ventricles are, however, its most frequent seat.

The hydrocephalic effusion sometimes leads to fatal results very soon after birth. In other cases no symptoms manifest themselves for some weeks or even during the first year, and all that is noticed is the increasing size of the head and the difficulty which the child has in keeping it erect. Even this symptom may, perhaps, be absent. Soon, however, signs of imperfect development begin to show themselves. The child, perhaps a year old, makes no effort to walk or to talk, and there are increasing evidences of mental deficiency. The child makes strange grimaces, is fretful and irritable, is often drowsy and does not notice objects like other children. There is an absence of expression in the face and only a silly vacant look, which seldom or never brightens up; saliva often dribbles from the half-open mouth. It is found impossible to teach the child to walk; he makes no effort to raise his legs or to put them forward. Standing is even difficult, the child tumbles and rolls about. Sometimes he appears deaf, but this is owing mainly to defective attention. The pupils are usually dilated; there is sometimes strabismus.

As the head increases in size, the nature of the complaint becomes more and more evident, owing to the symptoms produced by the weight. The face looks very small in proportion to the skull, and forms with it a triangle with the apex at the chin; prominent veins are seen on the forehead and sides of the head, the hair is thin, the eyeballs sunken, the head rolls from side to side and hangs down on the child's shoulders for support. Headache and vomiting are common symptoms; convulsions also occur, the sensory and motor functions become more and more depressed, the child becomes emaciated and gradually sinks. The symptoms occasionally become stationary, but relapses are frequent. In a few milder cases, the improvement is permanent, and partial recovery takes place. As a general rule, hydrocephalic children die in early childhood, and very often from some intercurrent disease, such as bronchitis or pneumonia. Sometimes death results from cerebral lesions, or meningitis and consequent coma, or effusion of blood into the arachnoid or ventricles, with the same result. Rupture of the ventricles is sometimes noticed, in which case the fluid escapes under the dura mater. But few patients reach puberty, and very few live to be middle-aged.

The diagnosis is for the most part easy, the appearance of the child being characteristic. In mild cases, the external appearances may resemble those of hypertrophy of the brain as occurs in rickets, but the condition of the child as regards intelligence is very different. Rickety children are often extremely precocious. It must not be forgotten, however, that rickets and hydrocephalus sometimes co-exist.

Treatment.—The treatment of hydrocephalus is very unsatisfactory. Various absorbent remedies have been tried. Calomel is given in doses of gr. $\frac{1}{4}$—$\frac{1}{2}$ three times a day, while mercurial ointment is applied to the head. This is continued for some weeks. Purgatives, diuretics and iodide of potassium have been administered with the same object; compression has been practised by means of strips of diachylon plaster; a third plan is that of puncturing and evacuating the fluid, but the patients rarely live long after the operation. In a few cases weak solutions of iodine have been injected after the tapping. It is better on the whole to have recourse to milder measures, such as counter-irritation behind the ears and the administration of iodide of iron and similar tonics. A long course of iodide of potassium may prove beneficial. Every endeavour should be made to improve the general health of the patient.

HYPERTROPHY OF THE BRAIN.

In Hypertrophy of the brain there is no augmentation of the nervous elements proper, but the interstitial substance is increased in quantity. With regard to the causes of this condition, little is definitely known; it may be that it is caused by persistent or recurrent hyperæmia. The condition is sometimes congenital, but it is more frequently developed some little time after birth; it is peculiar to childhood. It is often accompanied by rickets and enlarged glands. Sometimes the patients are cretins or idiots.

Anatomical Appearances.—The brain is larger and heavier than natural, and appears to be too large for its bony case. The membranes are thin and bloodless. There is no fluid in the sub arachnoid space. The surface of the convolutions is flattened, and the sulci between them are scarcely perceptible. The ventricles are small, the substance of the brain appears bloodless and dry. Its consistence and elasticity are increased. It sometimes happens that the hypertrophy is partial, and limited to one hemisphere, to the thalami optici, the pons Varolii, or the medulla oblongata.

&c. (which often appear periodically and are attended with fever), are caused by fresh attacks of meningitis and encephalitis.

Treatment.—Only in a few comparatively slight cases, and in those in which the cause is obvious and removable, can anything be done in the way of treatment. When the symptoms are due to abuse of alcohol or poisoning by lead, the course to be adopted is obvious. In other cases the treatment is that of chronic meningitis. The patient must be well fed and removed from all sources of excitement. The muscles may be stimulated by the induced current of electricity. Any marked symptoms such as headache, neuralgia, &c., require appropriate treatment.

APHASIA. APHEMIA. AMNESIA.

These terms signify loss or defect in various forms of the faculty of articulate speech. The disease is purely mental. Defect of articulate speech, as a symptom in right hemiplegia, occurs in a majority of cases. A few cases of aphasia with left hemiplegia are also reported, and the patients have generally been left-handed. Aphasia signifies a group of clinical phenomena connected with defect or loss of articulate speech. It includes mutism from any cause. The term implies impairment or want of power to recall words to express the idea framed in the mind, or to give to the words an articulate expression. The mind is sound or intact, and there is no trace of imbecility. There is perfect comprehension of words spoken by others, of written words which the patient sees, and of his own errors of expression. The idea is formed, but the appropriate words seem beyond his recollection; he cannot perform the act of verbal expression. The parts involved in speaking, or the organs of articulation, are all normal. Affections of articulate speech may be divided into four classes—(*a*) the motor nerves of the organs of speech are paralysed, and there is inability to use these organs (aphonia); (*b*) the co-ordinating centre to the nerve-origins, or which regulates the movements involved in speech is affected, and although the patients have complete control over the movements of the lips and tongue, they cannot articulate sound or cause the organs of speech to execute their combined movements (ataxic aphasia); (*c*) mental derangements, the portion of the brain where words are transformed into ideas and thoughts and acts, is diseased, and thus there is loss of memory of words and of other mental attributes; this class is known as amnesia; (*d*) where both the co-ordinating centre of nerve-origins of speech and the portion of the brain where words are transformed into thoughts and acts are affected.

Pathology.—Talking or ordinary conversation implies three distinct things—voice, articulation, and speech. The voice is a sound produced by the larynx, and hence aphonia or loss of voice is due to defect or paralysis of the larynx. Articulation implies words which express our thoughts, and which flow themselves momentarily, and without any attention being paid to their utterance by the combined movements of our lips, tongue, and palâte. Speech consists in the perfect production of elementary articulate sounds and in the sound expression of ideas, and has its source in that part of the brain in which words are transformed into ideas and revived into thought. For perfect speech there must be soundness of the (1) cortex of the brain which is the seat of the intellect; (2) the nerve fibres going from the cortex to the bulb; (3) the co-ordinating centres which are the conductors of the will; (4) the bulb; (5) the nuclei of nerves which supply the muscles of speech; (6) the nerves themselves; and (7) the muscles. The co-ordinating centre is said to be situated in the third frontal convolution, somewhere below the corpus striatum. During health this centre receives impression of thoughts and acts, regulates or combines groups or movements and causes the organs of speech to execute these combined movements.

In disease involving the co-ordinating centre, or in lesions situated between it and the part of the brain where ideas are formed and revived into thoughts, or in morbid conditions of the tract between the co-ordinating centre and the nerve-nuclei below, mutism is the result. Aphasia or the loss of power of speech includes defects in the organs of articulation and also those relating to reading and writing. A patient with aphasia can sometimes write without mistake, but more often the defect of co-ordination is as manifest in written as in spoken composition. Agraphia is then said to exist. In aphasia there is often hemiplegia of the right side, with a lesion of the left cerebral hemisphere, occupying a portion of the corpus striatum, the island of Reil, and some neighbouring convolutions. The posterior third of the third frontal convolution on the left side, called Broca's convolution, is mostly affected. These nerve-centres are supplied by the middle cerebral artery which is the commonest seat of embolism, and hence aphasia almost always occurs after a seizure due to embolus. In aphasia we must note the kind of hemiplegia. Where the arm suffers more than the leg the speech is greatly impaired. Where the disease is limited to a lateral portion of the brain it may destroy the speech, but without causing true aphasia. All these peculiarities vary in degree, and any or all of the above abnormalities may exist in an individual case. Lesions of motor nerves of the

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In locomotor ataxy and in insular sclerosis the utterance is slow and tremulous; there is stammering, which shows a change in the medulla, and which is often attended with marked efforts on the part of the tongue and lips; the syllables are divided and there is a tendency to scan the sentences. In glosso-labio-laryngeal paralysis there is, besides the loss of the power of articulation, paralysis of the lips, tongue, and soft palate, loss of power of retaining saliva in the mouth and of swallowing, and affection of the co-ordinating centres. In the class of cases known as ataxic aphasia, a patient recovering from unconsciousness is found to be speechless, although every other faculty is regained. There is no loss of memory of words. The power of reasoning and of concentration of thoughts is preserved. He can hear the speech, and understand everything said or read, converse by means of writing, and express his ideas by signs. He can use his lips and tongue for every other purpose except for speech. In other cases where the patient can speak but cannot write, the term *Agraphia* would be used. In such cases the faculty of language is not entirely lost, but the automatic flow of words from the lips, without any attention being paid to their movements, as occurs in ordinary conversation, fails in these patients. Many cases of aphasia are recorded where the patients have acquitted themselves very creditably at games where skill, quickness in movements, quickness of perception and the use of their senses were required. The third class, mental derangements, includes amnesic aphasia, or cases where there is loss of memory of words, the patient with perfect power of utterance is unable to converse, with perfect vision he is unable to read to himself or to others, and with perfect use of hand or arm he cannot write or make himself understood by writing. He has forgotten words, is unable to recall facts and is incapable of pursuing any train of reasoning. There is interference both with articulation and diction. In some cases the patient attempts to speak, perhaps utters a word or two correctly and then stumbles a little or stops. He seems to understand everything that is said to him and for the moment he can articulate every word which is dictated to him. It is curious enough that the words heard are, by a voluntary effort, reproduced by the organs of speech and he can recall for the moment to his mind the ideas which properly attach to them. In the same way he could convey written words to his mind through his eyes, although he cannot utter them. He cannot name the letters, or point them out if named to him. The same difficulty is noticed about him in writing. He can write from a copy, but when he tries to write without such aid he makes a series of up and down strokes. Manifesting a dim recollection of the art of writing, he often writes a letter or two, and then passes on to unmeaning strokes. In writing there is close sympathy between the eye and the hands, he sees the printed copy, and by an effort of the will reproduces it automatically in writing, yet he does not understand what he sees, or what he writes himself. In complete cases, the idea and intellect are both affected. The power to write or express ideas by signs is lost. There is inability to recollect the language expressive of the ideas which may be in the mind. Such patients are able to repeat dictated words. Where the ataxic and amnesic aphasia are combined, the patient is unable to write or repeat words from dictation, or to speak. He is not imbecile, as shown by the fact that the language expressed to the eye is understood by him. Thus in the ataxic form the intellect is defective from the first, in the amnesic variety the defective intellect follows the attack.

Aphasia of either variety may be complete or incomplete. In many cases there are superadded other forms of sensory, motor, or mental derangements. Often there is occasional misuse of certain words, or omission of certain words in writing or speaking, or the addition of wrong beginnings or endings to words, or transposition of syllables or letters. In some cases again, the patient, whenever he makes an attempt to speak, only utters a word or two, or only repeats words which are dictated to him; in other cases again, he gives loud utterances to words which are also indistinct.

Another class includes cases of aphemia and amnesia combined, or of aphemia, amnesia and paralysis of the organs of speech. In these cases, which are by far the most numerous, the patient, after an attack of right hemiplegia, absolutely loses power of speech, or only utters one or two inarticulate words, or has paralysis of the lips and tongue, he apparently understands everything, and even points out words in a printed book correctly as in aphemia. Gradually or suddenly he can articulate words but has forgotten the names of things, and is then found to be suffering from aphemia and amnesia combined.

An example may help to illustrate the symptoms and phenomena of aphasia. An officer with aortic disease had an apoplectic seizure, and continued aphasic after he had recovered to a great extent the use of his paralysed side, and he recollected only three words. These he used as a sort of formulæ. Thus, he had served through the war in the Peninsula, and had lived a great deal abroad. Whenever he wished to allude to this time of his life he used the word *Sea*. He spoke, or he had been able to speak Portuguese, and when aphasic, retained perfect understanding of that and three other languages, though only able to utter three words and those English. He was one day walking with some members of his family, and they were talking about a friend in Portugal. He listened attentively. They could not recollect the name of one of the people spoken of. He seemed to recollect, but could express nothing. As they walked on they passed an old iron pot; he stopped and pointed to it with his stick. His sister did not understand at first what he meant; then she guessed that it had something to do with the name, and asked him if it had. He nodded assent. She tried all sorts of English words suggested by the broken vessel, he shook his head at all, and said *Sea*. By this she guessed that he meant something in Portuguese, which she also spoke, and said *Caldero*, the word for a pot. He nodded assent, and she recollected that Caldero was the surname they had been unable to call to mind.

Prognosis.—Some cases of aphasia do not improve at all, those that get quite well usually do so in the first month. Others manifest very slight improvement indeed. Cases do not usually get worse unless there is a second seizure.

The treatment is that of the lesion to which the symptom is due. No special rules can be laid down.

DISEASES OF THE SPINAL CORD AND ITS MEMBRANES.—HYPERÆMIA OF THE SPINAL CORD.

On post-mortem examinations we find varying amounts of blood contained in the vessels of the spinal cord and its membranes, and we hence infer that similar conditions exist during life and give rise to certain symptoms of a more or less definite character. Sometimes an unusual amount of blood is contained in the cord, and on the other hand the quantity is sometimes less than normal. As in the case of the brain, these two conditions are termed respectively *hyperæmia* and *anæmia*. Their recognition is, however, for the most part very difficult unless the appearances are of a very marked character. Hyperæmia of the spinal cord and its membranes occurs in inflammation of these structures and is likewise found in the bodies of persons who have died from carbonic acid poisoning, poisoning by strychnia and prussic acid and in cases of death from tetanus and convulsions; it is also seen as the result of blows or falls on the back. It also accompanies congestion of certain abdominal viscera, as the uterus and the liver, and is often associated with general internal congestion, arising from diseases of the lungs or heart.

Anatomical Appearances.—In a hyperæmic condition of the spinal cord, the grey substance is somewhat swollen and of a reddish or brownish colour; the white substance is only slightly reddened. The structure of the cord is softer than natural and more or less infiltrated with fluid. In severe cases there is rupture of vessels and minute extravasations of blood. When the membranes are involved, the vessels of the pia mater, and the venous plexus of the dura mater, are surcharged with blood. Extravasations of blood of a greater or less extent are also observed and there is sometimes a considerable increase in the cerebro-spinal fluid, the pressure of which may be the cause of an opposite condition, viz., anæmia, in the cord itself. In all cases it must be remembered that after death, and often in severe illnesses, before that event takes place, blood accumulates in the most dependent parts, and congestion of the spinal meninges is often attributable to this cause (hypostatic congestion).

Symptoms.—The symptoms of hyperæmia of the spinal cord vary according to the cause to which the condition is due and the part of the cord affected. There is generally pain, of a dull character, in the lower part of the dorsal and lumbar regions; a feeling of tingling, weakness and stiffness in the legs; sometimes the upper extremities are thus affected. The intensity of the symptoms varies at different times; they are seldom very marked and often disappear and again return. The weakness of the limbs does not amount to paralysis. The symptoms, as a rule, are of a somewhat indefinite character. Hyperæmia of the spinal cord has been supposed to be the condition of the parts which exists in the so-called "spinal irritation" which is characterised by pain and tenderness on pressure over certain vertebræ. These symptoms are sometimes noticed in hysterical and hypochondriacal subjects, and are often associated with neuralgia and other evidences of nervous derangement. The exact condition which gives rise to the symptoms is, however, unknown. There is no real evidence that hyperæmia of the cord is present in these cases.

Treatment.—If the cause can be ascertained, it must be removed or dealt with as far as possible. To subdue the hyperæmia itself cupping or leeching may be applied to the spine. Warm foot-baths will also be serviceable. If constipation exists, laxatives should be given, and of these, the salines are the most suitable. The bowels should be kept freely open. To relieve pain, counter-irritants, as small flying blisters, may be applied on each side of the line of the spinous processes, or the Liniment Sinapis Comp. may be rubbed in. If these fail to relieve, the Liniment of Belladonna, mixed with equal parts of Liniment of Aconite and Chloroform, may be applied with a brush. As internal remedies, Bromide of Potassium may be given with small doses of Tinct. Belladonnæ or Tinct. Aconiti. Ergot of rye also tends to relieve congestion of the cord. In chronic cases, douches may be tried, and tonics, as quinine, are advisable. Where the pain is apparently of a neuralgic character, tincture of gelsemium will be likely to afford relief.

ANÆMIA OF THE SPINAL CORD.

This is a very rare condition, or at all events, it very seldom happens that there is any real evidence of its existence. Probably the spinal cord suffers, in common with other organs of the body, in cases of general anæmia. Anæmic persons are usually weak as regards their muscles, and the weakness may display itself particularly in those of the legs which have to bear the weight of the body. Anæmia of limited portions of the spinal cord may also be due to embolism or thrombosis, but such a condition would not be of a permanent character. Either a collateral circulation would be set up, or the nutrition of the part would be permanently affected, with softening as a result. Another form of spinal anæmia is seen in cases where the cord is compressed by tumours of the meninges, or of the vertebræ. Spasm of the arteries of the spinal cord is supposed by Dr. Brown-Séquard to give rise to anæmia. A condition of this kind, of a permanent character, would lead to softening. In cases in which the abdominal aorta is compressed and the blood-supply cut off, a condition of anæmia is set up in the spinal cord, with paralysis as a result. Such a paralysis, however, is only temporary, as collateral circulation soon becomes established. Certain drugs cause anæmia, or rather perhaps lessen hyperæmia of the cord. Among these may be mentioned, ergot of rye, belladonna and bromide of potassium.

Treatment.—The causal indications must be fulfilled if possible. In cases of manifest anæmia, the various preparations of iron and other tonics should be administered. If there be a history of syphilis, iodide of potassium should be given in full doses and continued for some time. Nourishing diet, wine and fresh country air are especially desirable. The continuous current may be tried to the spine. Tepid salt-water baths and douches carefully applied to the back are also likely to prove serviceable.

SPINAL IRRITATION—RACHIALGIA.

Spinal irritation, according to Dr. Brown-Séquard, is an affection which has a real existence and deserves a special name. He adopts the term *rachialgia*, and defines it to be a condition in which there is morbid excitability of the sensitive nerves of the spine, manifested by spontaneous pains, and by tenderness under pressure or on motion. The condition is more common in women than in men. The causes appear to be: excessive exercise, violent movements, a blow on the back, uterine derangements, excessive sexual intercourse, and previous severe and exhausting disease.

Anatomical Appearances.—Either no organic alteration, or at most a condition of hyperæmia. As a matter of course, the symptoms are often connected with definite lesions and various pathological alterations. Dr. Quain thinks that spinal pain and tenderness are frequently transmitted phenomena connected with morbid states of the mucous membrane. Thus cervical spinal irritation is often due to congestion of the pharynx; a similar condition of the dorsal region occurs in cases of gastric irritation, while pain and tenderness may be set up in the lumbar region by lesions of the mucous membrane of the intestines, or of the urinary or generative organs.

Symptoms.—Spinal tenderness is the only constant and essential symptom. It may be found at any part of the spine and is elicited by pressure or movement. It is most decided in some cases over the spinous processes, and in others, over the transverse processes. Cutaneous hyperæsthesia is often associated with it. There may be excessive tenderness with very little spontaneous pain, or comparatively slight tenderness when severe pain is constantly complained of. Spontaneous pain exists in about one-third of the cases of spinal irritation. It is always increased by motion or pressure. Its character varies; it may be heavy and dull, or sharp and severe, and either confined to one spot, or extending along the whole of the spine. The pain is usually diminished, though sometimes increased, when the patient is lying on the back. It is sometimes accompanied by functional disturbances of the viscera, especially of the stomach and heart, by vaso-motor disturbances and motor disorders, *e.g.* contraction of the muscles of the forearm. When there is general tenderness of the spine the symptoms show themselves in the four limbs and in the heart and stomach. The symptoms most commonly appear in the dorsal region; there is pain, tenderness, palpitation of the heart, and disorder of the stomach. When the irritation is localised in the cervical region, headache, sleeplessness, giddiness, pains in the neck, chest, and throat, disorders of speech and respiration, cough, and palpitation of the heart are the most prominent symptoms. The lumbar region is rarely affected. Pain in the legs, loins and back, spasm of the sphincters, uterine disorders and disorders of motility are the usual symptoms.

The *diagnosis* is for the most part easy, and is greatly facilitated by attention to the history of the case. The symptoms, however, are often mingled with those of hysteria. It is necessary in all cases to prove the absence of distinct lesions, such as those of the vertebræ, &c.

The *prognosis*, according to Dr. Brown-Séquard, is somewhat grave, many cases proving very obstinate, and recurring repeatedly after apparent cure. The symptoms are often very distressing, and many patients readily fall into a low, desponding or irritable condition.

Treatment. This should be of a tonic character; zinc and arsenic are serviceable in some cases. Subcutaneous injections of morphia with atropia near the seat of pain often afford great relief. The same result is occasionally obtained by hot, and sometimes by cold, applications. The use of the actual cautery to the skin of the back will sometimes relieve when all other means have failed. The iron at a *white* heat must be drawn rapidly down the back for a few inches. The operation causes no pain; and no sore of any kind is produced; the epidermis becomes dry and desquamates. A Paquelin cautery is a very convenient instrument for the purpose. *Absolute rest* for long periods is often highly beneficial.

Hæmorrhages of the Spinal Cord and its Membranes. Spinal Apoplexy.

In comparison with cerebral hæmorrhage, hæmorrhages of the spinal cord are of rare occurrence. Small superficial ecchymoses are sometimes noticed as a result of hyperæmia, in spinal meningitis and myelitis and in other spinal diseases, but more considerable effusions are sometimes found (1) in the substance of the cord (2), between the layers of the arachnoid and (3), between the dura mater and the bones, in the space occupied by loose connective tissue, and containing many venous ramifications. Hæmorrhage, such as occurs in the brain as a result of arterial degeneration and cardiac disease, is seldom, if ever, seen in the spinal cord; spontaneous hæmorrhage more often occurs in the medulla oblongata. The most common cause of spinal hæmorrhage is violence or concussion, either as a result of direct injury to the back, with or without fracture of the vertebræ, or in consequence of the shock being transmitted from other parts, as from the feet. Spinal hæmorrhage sometimes takes place in newborn infants, as a result of difficult labour and force used in delivery. In tetanus and other convulsive diseases it occasionally happens that the distended spinal vessels become lacerated and effusion takes place. Accumulation of blood, or of bloody serum, in the vertebral canal is sometimes the result of hæmorrhage between the membranes of the brain, the fluid finding its way between the layers of the arachnoid. Hæmorrhage as a result of concussion may occur in almost any region of the spinal cord, and either in the grey matter or in the white substance, or in both at the same time. Other causes of spinal hæmorrhage are various morbid processes which give rise to softening of the tissue. During the development of soft tumours likewise, rupture of vessels is apt to take place. The softening may be secondary to the hæmorrhage, but in other cases, hæmorrhage takes place into a mass of softened tissue of the spinal cord, just as occurs in the brain. The blood is coagulated and forms roundish masses, as in the brain, or the clots may extend longitudinally in the direction of, and between the fibres, or into the broken-down grey substance. Sometimes the central canal is found filled with blood. The quantity of blood effused is sometimes comparatively large and then it is generally found in the central part of the grey matter. The scorbutic state is said to predispose to spinal hæmorrhage, but there is generally some distinct exciting cause, such as excessive muscular exertion. The changes which the hæmorrhagic effusion undergoes in the course of time resemble those which are seen in cases of cerebral apoplexy. Spinal hæmorrhage from non-traumatic causes is most common in persons between the ages of twenty and forty, and the predisposition does not increase as age advances.

Symptoms. — These, of course, vary, according as the hæmorrhage has taken place into the cervical, dorsal, or lumbar region, and likewise according to the causes and the extent of the lesion. The symptoms come on suddenly, and are indicative of more or less intense irritation of the meninges. There is sudden and severe pain in the back, its seat corresponding to the position of the hæmorrhage, pain and numbness in the limbs (legs or arms, according to the seat of the mischief), stiffness of the muscles of the back and of the extremities, and marked hyperæsthesia of the skin. If the extravasation causes compression of the spinal cord, there will be incomplete paralysis or weakness of the limbs, anæsthesia, and more or less paralysis of the bladder and rectum. If the paralysis be complete, it may be suspected that the effusion is considerable, and into the substance of the cord itself. If the upper part of the cervical portion be affected death may occur at once, or after a few hours or days; sometimes the first symptoms subside, to be shortly followed by a return in an aggravated form, and accompanied by symptoms of inflammatory fever. If these pass off, absorption may occur and improvement supervene, with gradual disappearance of all the symptoms.

In cases in which there is complete paralysis of motion and sensation, extending from the cervical, thoracic, or lumbar region, the probability is that extensive hæmorrhage has taken place into the substance of the cord itself, and the prognosis in such cases is very unfavourable. It is not easy to distinguish between such lesions and those in which the hæmorrhage is external to the dura mater; in both cases there is sudden paralysis, sudden pain, and more or less complete anæsthesia. When the hæmorrhage is external to the dura mater, the paralysis of sensation is less marked than that of motion, while ultimate recovery is far more probable than when the substance of the cord is affected. In paraplegia due to thrombosis, the symptoms set in suddenly, but are usually incomplete, and sensation is not much, if at all, affected. As time goes on, however, the motor paralysis may become more marked and be accompanied by paralysis of sensation.

Prognosis.—This is for the most part unfavorable, if there is reason to believe that the hæmorrhage has taken place into the substance of the cord, either as a primary affection or as a result of softening; laceration and disintegration of the nervous tissue being produced in both cases. Extravasations into the upper portions of the spinal marrow are more serious, as regards life, than those which occur lower down. In the former case death may occur as a result of the medulla oblongata being involved; in the latter paraplegia of a permanent character may ensue, and the fatal result may be due to vesical paralysis, cystitis, and renal disease. In cases where the hæmorrhage is slight, and limited to a small portion of the cord, the prognosis is much more favourable. Recovery, either partial or complete, may be expected to take place.

Treatment.—Absolute quietude and rest in the prone position must be enjoined. Venesection may be performed if the patient be robust, or leeches or cupping may be applied in the neighbourhood of the affected part. A bladder of ice should be kept in contact with the spine. The diet must be of a liquid, non-stimulating character. If the heart's action be much excited, digitalis, in the form of the tincture, may be given in combination with bromide f potassium. Morphia subcutaneously may be used to relieve the n, if very severe. If symptoms of meningeal inflammation super- e, the ice must be assiduously applied, and small doses of calomel must be given every two hours. The state of the bladder must be very carefully attended to, and every effort made to prevent bed-sores. Constipation may be relieved by enemata. Iodide of potassium will probably be of service in the after-treatment.

SPINAL MENINGITIS—INFLAMMATION OF THE SPINAL MEMBRANES.

Of the membranes of the spinal cord the pia mater and the arachnoid are the most prone to be affected; the dura mater sometimes suffers, but generally as a consequence of injury. The spinal pia mater is sometimes the seat of tubercular inflammation, in which case the affection always complicates a similar lesion at the base of the brain. In one of the non-tubercular forms, the epidemic cerebro-spinal meningitis, both parts are also affected at the same time. With regard to the cause, the disease is most prone to attack young persons, and those who are badly fed and are otherwise unfavorably situated. For the development of the tubercular form, those factors are required which produce tuberculosis generally.

The causes of the simple form are—injuries of various kinds, exposure to cold and wet, disease of the vertebræ, deep-seated bed-sores, and suppuration due to other causes in the neighbourhood of the vertebræ, certain acute diseases, as the infectious fevers and acute exanthemata, and the existence of other spinal or cerebral disease. When the pia mater only is affected, the complaint is called *lepto-meningitis;* inflammation of the dura mater is designated *pachymeningitis.*

Anatomical Appearances.—When the dura mater is inflamed, as occurs in cases of caries of the vertebræ and as a result of wounds and injuries, the external surface of that membrane is seen to be affected, and also the loose connective tissue between it and the bones. The membrane itself is thickened and discoloured, and the connective tissue is infiltrated with fibrinous or purulent effusion, sometimes to such an extent that the spinal cord is much compressed. It sometimes happens, however, that the internal surface of the spinal dura mater is the seat of an inflammatory process of a hæmorrhagic kind, and resembling hæmatoma of the corresponding membrane of the brain. This condition is sometimes due to injury, and has been observed in cases of acute alcoholism, associated with a similar condition of the cerebral dura mater. The roots of the nerves passing through the inflamed membrane are generally implicated in the inflammatory process, and they are sometimes compressed or atrophied. The inflammation may be limited to the vicinity of two or three vertebræ, or it may affect the whole irritants, as small flying blisters, may be applied on each side of the line of the spinous processes, or the Liniment Sinapis Comp. may be rubbed in. If these fail to relieve, the Liniment of Belladonna, mixed with equal parts of Liniment of Aconite and Chloroform, may be applied with a brush. As internal remedies, Bromide of Potassium may be given with small doses of Tinct. Belladonnæ or Tinct. Aconiti. Ergot of rye also tends to relieve congestion of the cord. In chronic cases, douches may be tried, and tonics, as quinine, are advisable. Where the pain is apparently of a neuralgic character, tincture of gelsemium will be likely to afford relief.

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Treatment. This should be of a tonic character; zinc and arsenic are serviceable in some cases. Subcutaneous injections of morphia with atropia near the seat of pain often afford great relief. The same result is occasionally obtained by hot, and sometimes by cold, applications. The use of the actual cautery to the skin of the back will sometimes relieve when all other means have failed. The iron at a *white* heat must be drawn rapidly down the back for a few inches. The operation causes no pain; and no sore of any kind is produced; the epidermis becomes dry and desquamates. A Paquelin cautery is a very convenient instrument for the purpose. ***Absolute rest*** for long periods is often highly beneficial.

HÆMORRHAGES OF THE SPINAL CORD AND ITS MEMBRANES.
SPINAL APOPLEXY.

In comparison with cerebral hæmorrhage, hæmorrhages of the spinal cord are of rare occurrence. Small superficial ecchymoses are sometimes noticed as a result of hyperæmia, in spinal meningitis and myelitis and in other spinal diseases, but more considerable effusions are sometimes found (1) in the substance of the cord (2), between the layers of the arachnoid and (3), between the dura mater and the bones, in the space occupied by loose connective tissue, and containing many venous ramifications. Hæmorrhage, such as occurs in the brain as a result of arterial degeneration and cardiac disease, is seldom, if ever, seen in the spinal cord; spontaneous hæmorrhage more often occurs in the medulla oblongata. The most common cause of spinal hæmorrhage is violence or concussion, either as a result of direct injury to the back, with or without fracture of the vertebræ, or in consequence of the shock being transmitted from other parts, as from the feet. Spinal hæmorrhage sometimes takes place in newborn infants, as a result of difficult labour and force used in delivery. In tetanus and other convulsive diseases it occasionally happens that the distended spinal vessels become lacerated and effusion takes place. Accumulation of blood, or of bloody serum, in the vertebral canal is sometimes the result of hæmorrhage between the membranes of the brain, the fluid finding its way between the layers of the arachnoid. Hæmorrhage as a result of concussion may occur in almost any region of the spinal cord, and either in the grey matter or in the white substance, or in both at the same time. Other causes of spinal hæmorrhage are various morbid processes which give rise to softening of the tissue. During the development of soft tumours likewise, rupture of vessels is apt to take place. The softening may be secondary to the hæmorrhage, but in other cases, hæmorrhage takes place into a mass of softened tissue of the spinal cord, just as occurs in the brain. The blood is coagulated and forms roundish masses, as in the brain, or the clots may extend longitudinally in the direction of, and between the fibres, or into the broken-down grey substance. Sometimes the central canal is found filled with blood. The quantity of blood effused is sometimes comparatively large and then it is generally found in the central part of the grey matter. The scorbutic state is said to predispose to spinal hæmorrhage, but there is generally some distinct exciting cause, such as excessive muscular exertion. The changes which the hæmorrhagic effusion undergoes in the course of time resemble those which are seen in cases of cerebral apoplexy. Spinal hæmorrhage from non-traumatic causes is most common in persons between the ages of twenty and forty, and the predisposition does not increase as age advances.

Symptoms. — These, of course, vary, according as the hæmorrhage has taken place into the cervical, dorsal, or lumbar region, and likewise according to the causes and the extent of the lesion. The symptoms come on suddenly, and are indicative of more or less intense irritation of the meninges. There is sudden and severe pain in the back, its seat corresponding to the position of the hæmorrhage, pain and numbness in the limbs (legs or arms, according to the seat of the mischief), stiffness of the muscles of the back and of the extremities, and marked hyperæsthesia of the skin. If the extravasation causes compression of the spinal cord, there will be incomplete paralysis or weakness of the limbs, anæsthesia, and more or less paralysis of the bladder and rectum. If the paralysis be complete, it may be suspected that the effusion is considerable, and into the substance of the cord itself. If the upper part of the cervical portion be affected death may occur at once, or after a few hours or days; sometimes the first symptoms subside, to be shortly followed by a return in an aggravated form, and accompanied by symptoms of inflammatory fever. If these pass off, absorption may occur and improvement supervene, with gradual disappearance of all the symptoms.

In cases in which there is complete paralysis of motion and sensation, extending from the cervical, thoracic, or lumbar region, the probability is that extensive hæmorrhage has taken place into the substance of the cord itself, and the prognosis in such cases is very unfavourable. It is not easy to distinguish between such lesions and those in which the hæmorrhage is external to the dura mater; in both cases there is sudden paralysis, sudden pain, and more or less complete anæsthesia. When the hæmorrhage is external to the dura mater, the paralysis of sensation is less marked than that of motion, while ultimate recovery is far more probable than when the substance of the cord is affected. In paraplegia due to thrombosis, the symptoms set in suddenly, but are usually incomplete, and sensation is not much, if at all, affected. As time goes on, however, the motor paralysis may become more marked and be accompanied by paralysis of sensation.

Prognosis.—This is for the most part unfavorable, if there is reason to believe that the hæmorrhage has taken place into the substance of the cord, either as a primary affection or as a result of softening; laceration and disintegration of the nervous tissue being produced in both cases. Extravasations into the upper portions of the spinal marrow are more serious, as regards life, than those which occur lower down. In the former case death may occur as a result of the medulla oblongata being involved; in the latter paraplegia of a permanent character may ensue, and the fatal result may be due to vesical paralysis, cystitis, and renal disease. In cases where the hæmorrhage is slight, and limited to a small portion of the cord, the prognosis is much more favourable. Recovery, either partial or complete, may be expected to take place.

Treatment.—Absolute quietude and rest in the prone position must be enjoined. Venesection may be performed if the patient be robust, or leeches or cupping may be applied in the neighbourhood of the affected part. A bladder of ice should be kept in contact with the spine. The diet must be of a liquid, non-stimulating character. If the heart's action be much excited, digitalis, in the form of the tincture, may be given in combination with bromide of potassium. Morphia subcutaneously may be used to relieve the pain, if very severe. If symptoms of meningeal inflammation supervene, the ice must be assiduously applied, and small doses of calomel must be given every two hours. The state of the bladder must be very carefully attended to, and every effort made to prevent bed-sores. Constipation may be relieved by enemata. Iodide of potassium will probably be of service in the after-treatment.

SPINAL MENINGITIS—INFLAMMATION OF THE SPINAL MEMBRANES.

Of the membranes of the spinal cord the pia mater and the arachnoid are the most prone to be affected; the dura mater sometimes suffers, but generally as a consequence of injury. The spinal pia mater is sometimes the seat of tubercular inflammation, in which case the affection always complicates a similar lesion at the base of the brain. In one of the non-tubercular forms, the epidemic cerebro-spinal meningitis, both parts are also affected at the same time. With regard to the cause, the disease is most prone to attack young persons, and those who are badly fed and are otherwise unfavorably situated. For the development of the tubercular form, those factors are required which produce tuberculosis generally.

The causes of the simple form are—injuries of various kinds, exposure to cold and wet, disease of the vertebræ, deep-seated bed-sores, and suppuration due to other causes in the neighbourhood of the vertebræ, certain acute diseases, as the infectious fevers and acute exanthemata, and the existence of other spinal or cerebral disease. When the pia mater only is affected, the complaint is called *lepto-meningitis;* inflammation of the dura mater is designated *pachymeningitis.*

Anatomical Appearances.—When the dura mater is inflamed, as occurs in cases of caries of the vertebræ and as a result of wounds and injuries, the external surface of that membrane is seen to be affected, and also the loose connective tissue between it and the bones. The membrane itself is thickened and discoloured, and the connective tissue is infiltrated with fibrinous or purulent effusion, sometimes to such an extent that the spinal cord is much compressed. It sometimes happens, however, that the internal surface of the spinal dura mater is the seat of an inflammatory process of a hæmorrhagic kind, and resembling hæmatoma of the corresponding membrane of the brain. This condition is sometimes due to injury, and has been observed in cases of acute alcoholism, associated with a similar condition of the cerebral dura mater. The roots of the nerves passing through the inflamed membrane are generally implicated in the inflammatory process, and they are sometimes compressed or atrophied. The inflammation may be limited to the vicinity of two or three vertebræ, or it may affect the whole length of the spinal dura mater. In certain chronic forms of spinal pachymeningitis the inner layers of the dura mater in the cervical region are mainly affected. In this condition, which has been called *hypertrophic cervical pachymeningitis*, there is marked hyperplasia of tissue-elements in the internal layers of the dura mater, resulting in the formation of layers of almost cicatricial hardness, and with a concentric arrangement. These layers adhere to the arachnoid and the pia mater, and these membranes become thickened. The nerve-roots in these cases are especially liable to be compressed and partially destroyed, and the cord itself is pressed upon, with paralysis and muscular atrophy as results.

When the pia mater and the arachnoid are inflamed, the mischief may extend over large patches, or over the whole extent of these membranes. In the acute form the arachnoid and pia mater are injected, swollen, and softened, and exhibit patches of ecchymosis; on their surface and in the meshes of the pia mater is an exudation, fibrinous in character or more or less purulent, and most abundant at the posterior part. The spinal fluid is turbid, and contains flakes of lymph or pus; the cord itself may be pale and bloodless, or hyperæmic or softened. In chronic cases the arachnoid and pia mater are thickened and indurated, and firmly adherent to the cord, which is generally softened or more or less changed. The inflammation often extends from the membranes to the cord, and sets up minor changes of an inflammatory type, capable of recognition by the microscope, though not amounting to actual softening. In the tubercular form of spinal meningitis the effusion consists of gelatinous serum or lymph rather than pus, and minute granulations in the form of whitish or yellowish specks are found in the connective tissue surrounding the vessels. The roots of the nerves are more or less involved in the inflammatory process, by the products of which they are compressed to a varying extent.

Symptoms.—The symptoms are closely similar, whether the dura mater alone or the arachnoid and pia mater are involved. If the symptoms occur in a patient suffering from caries of the vertebræ or from deep ulcerative processes in the back, *e.g.* a sloughing bedsore, the probability will be that the dura mater and the connective tissue between it and the bones are the seat of inflammation.

Acute inflammation of the spinal pia mater and arachnoid generally sets in with a feeling of chilliness, followed by fever and severe pain in the back, confined to a limited part, or spread over its entire length; the pain is aggravated by pressure or movement, by the latter especially if the mischief be in the dorsal region. The pain becomes aggravated from time to time, and may be considered as due to rheumatism, especially if the patient has been exposed to cold. The pain often extends round the body like a girdle, and shoots into the limbs and joints. Increased sensitiveness of the skin, especially marked in the lower extremities, is another prominent symptom; a slight touch causes severe pain, and the patient cries out if moved. The motor nerves are likewise affected; the muscles of the back and legs become rigid, and all attempts to move them cause pain. There is sometimes opisthotonos and an exaltation of reflex movements, so that the case may resemble tetanus, in which, however, both these conditions are more marked, while trismus is a prominent feature, but there is no history of any febrile stage.

The course of the temperature varies; it falls after the first onset of the disease, and may never rise above 101° or 102°, till shortly before death, when, in some cases, it rises one or two degrees more. In other cases it falls shortly before death to below the normal.

There is often some difficulty in micturition and defæcation, and this is probably due to spasmodic action of the sphincters. When the mischief is high up in the cervical region the respiration and the action of the heart may be considerably interfered with. These symptoms are probably due to implication of the cerebral meninges.

In severe cases all the symptoms rapidly reach their acme; breathing and swallowing become difficult, and death follows in two or three weeks. In milder cases partial or complete recovery may follow; in the former case the pains become less, and the hyperæsthesia subsides, but paresis or paralysis of certain muscles remains, and the superficial myelitis may result in softening, or in some cases in sclerosis, of the cord. The symptoms vary according to the severity and extent of the process, its cause, and the complications which may exist.

Diagnosis.—This is for the most part easily made, if the symptoms be severe. Chilliness, followed by fever; pains in the back and limbs, aggravated by pressure on the spine or movements; rigidity and muscular spasm; hyperæsthesia of the skin; retention of urine and fæces; and more or less paralysis of the limbs, are diagnostic symptoms. If the cerebral membranes be simultaneously attacked, there will be, in addition, pain in the head, vomiting, disorder of special senses, delirium, strabismus, difficulty of deglutition and speech, &c. It is difficult to decide between spinal meningitis and myelitis, and it must be remembered that the two conditions are often combined. Boring pain in the back, pain in the limbs, hyperæsthesia, and rigidity of the muscles, point towards meningitis, while if these symptoms be only slightly marked and paralysis be a prominent feature, the probability is that the case is one of myelitis.

Prognosis.—This depends upon the cause, extent, and severity of the lesion, the presence or absence of cerebral symptoms, and the age and state of health of the patient. Complete recovery is rare in well-marked cases; under the most favorable conditions some of the symptoms generally persist in a chronic form. When the symptoms follow a sloughing bedsore, the case soon ends fatally. Extension to the cerebral membranes is also a fatal sign. When the disease occurs in the cervical region the prognosis is more grave than when the dorsal region is attacked.

Treatment.—The treatment of acute spinal meningitis must be of a strictly antiphlogistic character. The patient should lie on his face, and leeches or cupping should be applied to the spine. Subsequently, bladders of ice may be placed over or around the affected part. Morphia may then be administered hypodermically. As an anti-inflammatory remedy calomel or blue pill may be given by the mouth, and blue ointment rubbed in. When the acute stage has subsided, the iodide of potassium may be given internally, and blisters applied to each side of the spine. As a matter of course the patient must be kept very quiet in a cool, well-ventilated room. His diet must be liquid, non-stimulating, and cautiously increased. The bowels must be kept open by enemata, and the urine must be withdrawn by means of a catheter, if necessary. The mercury must not be pushed too far; the slightest influence on the gums will suffice. As time goes on, and if the symptoms improve, the diet must be of a more nourishing character, and stimulants may be advisable. When all acute symptoms have disappeared warm baths will probably be of service, and, later on, douches to the spine. Tonic treatment will then become necessary, and electricity may be used, with the hope of removing any remaining paralysis. For these cases a course of bathing at some warm spring, as at Bath or at Wildbad in Germany, is often highly beneficial. Carefully conducted rubbing may also be recommended to improve the nutrition of any paralysed parts. All injurious influences likely to induce a relapse must be scrupulously avoided.

MYELITIS—INFLAMMATION OF THE SPINAL CORD.

Myelitis is an inflammation of the spinal cord. The whole substance of the cord, or a greater or less tract of it, becomes eventually either more or less softened down or hardened, or undergoes other degenerative changes. When the degeneration is general all the functions of the cord are suspended; when it is restricted to a limited portion the patient may live for some time, exhibiting various forms of paralysis.

Pathology.—In myelitis the inflammation of the cord leads to changes in the nerve-elements. At first their nutrition becomes altered, gradually degenerative structural changes take place in the nerve-filaments and ganglion-cells. The first change is hyperæmia; this is followed by infiltration with young cells and softening, and the tissue becomes red or mottled, and afterwards brownish or brownish-yellow. The nerve-fibres become degenerated, and the ganglion-cells and cells of the neuroglia undergo fatty degeneration.

Causes.—Myelitis is generally due to extension of inflammation from the vertebræ or the membranes. Direct injury, as wounds; caries of the vertebræ and severe sprains or concussion, the presence within the vertebral canal of adventitious growths, syphilitic or otherwise, and hæmorrhages, are all occasional causes of myelitis. Myelitis sometimes results from neuritis following injury of a peripheral nerve (neuritis ascendens). It also is an occasional sequel of sexual excesses and other intemperate habits. It sometimes follows the exanthemata, erysipelas and puerperal fever, and is occasionally observed as a sequel of diphtheria and of dysentery, and after vesical and renal diseases.

Post-mortem appearances.—These are of the same character as those found in encephalitis. There is either more or less softening or else hardness in a circumscribed spot, or in several limited spots, usually in the grey substance. When myelitis is secondary to diseases of the vertebræ, the white substance is at first affected, and then at a later period the grey matter. The disease often extends to the whole cord, which becomes thin and diffluent, and shows broken-up tissue, yellowish or brown in colour (yellow softening). This is owing to changes in the hæmatin and degenerated nerve-elements. Sometimes clots of blood are seen on its surface and in its substance. In a few cases the inflamed spot is converted into an abscess. It sometimes happens that cavities are formed, filled with opaque serum and crossed by strands of thickened connective tissue. Signs of coexistent inflammation of the membranes are often present, especially where the more superficial parts are affected. Rarely the disintegrated tissue forms hard indurations or sclerosed spots. The inflammatory process sometimes extends along the nerves, and the muscles they supply are pale and flabby.

Symptoms.—These somewhat resemble those of inflammation of the meninges. At the beginning there is high fever with severe pain in the limbs and back, or along the spine. The pain is increased on movements and pressure. Formication, pains in the extremities which soon become paralysed, and a feeling of constriction and pain round the body are generally present. There is spasm of the muscles of the neck and back, and contractions of the muscles of the extremities with spasmodic jerks. Where the respiratory muscles are affected, there is dyspnœa. All these symptoms of irritation are soon followed by paralysis, generally in the form of paraplegia. Most paraplegias which come on during diseases of the vertebræ are due to myelitis. When due to violence, falls, &c., the patient is paralysed in the parts below the seat of injury. In myelitis as a general rule, there is no difficulty of swallowing, the speech is normal, and there is no facial palsy. In idiopathic cases myelitis is primary and affects the grey matter, and hence both the sensation and motion will be affected. When myelitis is due to extension from the membranes or the vertebræ, the white matter of the cord is mainly affected, and therefore motion is more impaired than sensation. The disease has a tendency to become diffused throughout the cord and thus to destroy its reflex functions and also the electric contractility of muscles. The affections of the spinal grey matter are unattended by pain, and therefore myelitis is not a painful disorder. The pain, if it exists, is due to pressure upon the sensory nerves within the canal, or on the posterior roots in their passage through the white matter. Hence pain may result from existing meningitis, or the existence of growths or tumours.

Myelitis is sometimes a chronic affection; the symptoms come on gradually, a patient, after exposure to cold or over-fatigue, or sleeping over damp grass has mild symptoms of irritation, as rigors, but no fever. The membranes are very slightly affected, and the symptoms are slight pains in the limbs, formication, contraction of the extremities, and a dull pain in the lumbar region. The pain is increased by pressure on the spinous processes. It is accompanied by a feeling as if a rope were drawn tight round the body, or a feeling of pins and needles from the waist downwards. If the lesion be severe, there is total inability or loss of motion in the legs and arms, or feet and toes, associated with complete anæsthesia of the lower part of the body. If a sponge, dipped in hot water, be passed over the spine, the affected portion will be found more sensitive than the rest. In a few cases there is no pain but only cutaneous hyperæsthesia. The patellar tendon-reflex and the ankle clonus are absent or feeble. There is want of control over the bladder and rectum, and in male patients often more or less priapism.

The electric examination is most important. When the paralysis is established, the muscles do not respond to the induced currents, and they also fail to contract under the continuous current. There is loss of electric muscular contractility, and diminution of temperature in the paralysed parts. The muscles of the legs are ill-nourished. Very often the affected muscles are the seat of twitchings and painful contractions. Experiments have shown that although the connection between the motor nerves and central filaments is disturbed, the reflex excitability from the sensory to the motor nerves is increased below the seat of interruption. In far advanced cases, the urine becomes ammoniacal and bed-sores form. In male patients impotence is a common symptom. If the inflammation be high up, the paralysis is more marked and respiration is impeded, and there may be difficulty of speech. In the disease affecting the lumbar region, only the lower limbs are paralysed. In cases of paraplegia, the paralysis is sometimes unequal on the two sides, one half of the spinal cord being more affected than the other. Hemiplegia due to a spinal lesion, is a rare affection. The disease affecting the dorsal region causes paraplegia with paralysis of the sphincters. The disease either terminates in death, or passes into sclerosis or into softening of the cord, and life may be prolonged for many years, but impairment or loss of motor power and of sensation persistently remains below the diseased portion.

Prognosis.—Acute myelitis is a grave disorder, and patients so attacked often die in a few days or a few weeks. The cause of death varies, it may be due to asthenia or apnœa, or to bed-sores. Cases, however, often occur in which paraplegia, as a result of myelitis, persists for an indefinite period. The patient is more or less confined to bed by the paralysis; and bed-sores and cystitis frequently occur, and sooner or later cause death. In patients suffering from chronic myelitis, the result of an acute attack, renal disease often supervenes and ultimately proves fatal. Sometimes the mischief extends in an upward direction to the cerebellum and cerebrum.

Treatment.—In the early stages of acute myelitis, the treatment must be of an antiphlogistic character. If there be severe pain in the back, fever, and other symptoms of irritation, leeches or cupping should be applied to the spine and followed by bladders of ice. The patient should be placed on a water-bed, and should lie on his face or side, and be kept as quiet as possible. In sthenic cases mercury may be tried with caution. The bowels should be freely relieved by non-irritating purgatives, as castor oil or aloes. Belladonna may be given internally to relieve pain; it is also supposed to lessen hyperæmia of the spinal cord. The disease, however, as a general rule, is of a subacute character, and active antiphlogistic treatment is not indicated. Counter-irritation in its various forms may be tried. Small flying blisters, often repeated, on each side of the spine, antimonial ointment rubbed in so as to cause pustules, iodine paint and the compound liniment of mustard of the Pharmacopœia, form the best applications for this purpose. Care must be taken, especially when the patient is confined to bed, to avoid extensive injury to the skin; bedsores are very liable to be thus produced. Iodide and bromide of potassium may be given internally, with the view of causing absorption and diminishing reflex excitability. The feet and legs should be kept warm; hot mustard pediluvia every day or every other day will be of service; or the feet and legs may be enveloped in flannel dipped in hot mustard-and-water, and wrung almost dry.

When the active symptoms have subsided, treatment of a different character may be had recourse to, but mild counter-irritation may be continued for a lengthened period. Electricity may now be tried. The constant current is the more suitable for the earlier periods. It may be applied directly to the spine, or one rheophore may be placed on the vertebræ and the other gently moved over the paralysed limbs or muscles. Great care is necessary in beginning this treatment; it must be forthwith discontinued if it appears to induce irritation. A daily application for a few minutes will be sufficient at first; afterwards the sitting may be prolonged to a quarter of an hour or more, and this treatment must be persevered with for some months. If there be no manifest improvement, the interrupted current may be tried. The general rule is to employ that form of current to which the muscles most readily respond, using the weakest current that will cause muscular contraction. In cases of myelitis of any severity, it is vain to expect much good effect from electricity. Something may often be done, however, towards improving the nutrition of the paralysed muscles.

Strychnia is a remedy which has been much vaunted at certain periods, but its efficacy has been decidedly overrated. It appears to do good in diphtheritic paraplegia, which, however, as a general rule, spontaneously disappears under tonic treatment, generous diet, &c. Strychnia, nevertheless, may be tried in cases in which there are no active symptoms. It should be given in small doses, $\frac{1}{30}$th of a grain gradually increased to $\frac{1}{20}$th three times a day, and should be continued until its milder physiological effects are produced.

Warm baths form another agency, of more or less decided utility in the treatment of myelitis. They may be combined with douches to the spine. If the patient's means will allow of it, he may be sent to a natural thermal spring, as that at Bath in England, or those at Wildbad and Teplitz in Germany. Some amount of improvement is often observed after a course of treatment at these places, the arrangements at which are, in many respects, all that could be desired. A course of warm baths in the patient's own house is, however, an efficient substitute.

As a matter of course, in advanced cases, the general treatment and regimen must be of a tonic character. Good nutritious food, fresh air, an occasional residence by the seaside, quinine, iron and wine will all be advantageous either in improving the condition or preventing rapid changes for the worse. Passive movements may be tried in order to check the wasting of the limbs, usually a very prominent feature of the complaint. Rubbing the muscles, "shampooing" is likely to be of service, and often makes the patient feel more comfortable. It is very important to attend to the condition of the bladder and bowels and to prevent bedsores. When there is retention of urine, the catheter should be used three times daily. The French bulbous instrument is the best for this purpose; it should be smeared over with vaseline to which a little carbolic acid has been added (gr. ij to ʒj). If the urine becomes offensive, the bladder should be washed out with a weak solution of permanganate of potash. The bowels should be kept open by enemata, or by aperients such as aloes. A good formula for the latter is Extract. Aloes. Soc. gr. ij—iv., Quiniæ Sulph. gr. j, Extract. Belladonnæ gr. ¼ misce, fiat pilula. If bedsores threaten, the patient should be placed on a water bed, and the part bathed with a strong spirit lotion, or a solution of nitrate of silver (gr. v to ʒj) may be applied.

CHRONIC INFLAMMATION OF THE CORD. SCLEROSIS.

Chronic myelitis is characterised by a slow disintegration and softening; more frequently by induration or grey degeneration of the cord. Sclerosis is an affection of inflammatory origin, and is associated with a slow development of adventitious fibroid tissue leading to induration or thickening of the nervous substance, and a greater or less increase of intercellular connective substance.

In advanced cases the sclerosis affects the white substance of the cord, and the tubules are diminished in thickness. There is partial disappearance of the white substance of Schwann, till at last the tubules are atrophied, wasted, and degenerated. When the sclerosis occupies the grey matter of the cord the changes are also noticed in the nerve-cells, which become swollen and granular, and their walls thickened. In some cases the nerve-cells become pigmented and atrophied, and at last wholly disappear. The sclerosis of the cord has a tendency to confine itself to certain tracts or regions, and it causes various forms of paralysis. Thus, sclerosis limited to the anterior cornua of the grey matter of the cord or to large nerve-cells within the grey matter, and may give rise to acute anterior poliomyelitis, or infantile and adult spinal paralysis; to general spinal paralysis, or to progressive muscular atrophy. Spastic spinal paralysis is due to a sclerotic change in the lateral white columns, which are generally symmetrically affected. Locomotor ataxy or tabes dorsalis includes cases of grey degeneration involving mainly the posterior white columns. The glosso-labio-laryngeal palsy is due to a variety of sclerosis where the motor nuclei of the medulla oblongata are the seat of the lesion. In diffuse chronic myelitis or disseminated sclerosis of the spinal medulla the change is scattered irregularly throughout the cord, and even through the brain, without any distinction of regions. Of these diffuse forms, the subacute attacks the dorso-lumbar region.

Treatment.—There is little to add on this head to what has been stated in the description of the treatment of the later stages of the acute form. The main indications are to improve the general health, to prevent, as far as possible, muscular atrophy, to obviate the occurrence of cystitis and of bedsores, and to keep the bowels open. Counter-irritation to the spine, tonics, electricity, shampooing, the use of the catheter, and of aperients, are the principal means at our command for the above purposes. Dr. Brown-Séquard recommends a method of counter-irritation described in the chapter on spinal irritation. As regards internal remedies, iodide of potassium may be tried, especially if syphilis be suspected; it may be combined with the bromide. Dr. Ringer has lately recommended the extract of Calabar bean for chronic myelitis. As a general rule, however, but little is to be expected from medicine. The paralyses are usually chronic, and continue during the lifetime of the patient. Death occurs either from renal affections, or extension of the spinal lesion in an upward direction.

SPINAL PARALYSIS.

Under this heading various forms of paralysis are grouped. They are all due to a morbid condition of the spinal cord. The various forms met with in practice are thus designated:—1. Infantile paralysis, in which the anterior columns and cornua are the principal seats of the lesions. 2. General or acute spinal paralysis of adults. 3. Spasmodic spinal paralysis or idiopathic lateral sclerosis. 4. Amyotrophic lateral sclerosis. 5. Multiple sclerosis.

INFANTILE SPINAL PARALYSIS.

This is a complaint which occurs in children between the ages of six months and three years. With regard to its causation, it has been observed that those affected are for the most part healthy in other respects, but they are sometimes delicate and excitable. Both sexes are equally liable to be attacked. It has been thought that such children are often the progeny of parents suffering from nervous affections, and it has been noticed that other members of the family have suffered from convulsions or hydrocephalus. Falls, injuries, and exposure to cold, have been assigned as causes of this affection, but nothing is positively known as to its etiology.

Anatomical Appearances.—It has been shown by the investigations of Cornil, Charcot, and Lockhart Clarke, that the lesions in the spinal cord are situated in its anterior part, viz. in the anterior cornua, the anterior columns, and the anterior part of the lateral columns, and the anterior roots of the nerves. The complaint is, therefore, allied in this respect to progressive muscular atrophy, but differs from it in being of an acute character. Atrophy and granular disintegration of the nerve-elements are the conditions which have been observed in the affected portions of the spinal cord.

Symptoms.—These set in suddenly, but there are generally some premonitory evidences of nervous derangement, such as restlessness, feverishness, pain in the back or limbs, and sometimes convulsions. Paralysis then sets in, generally of the lower extremities. The paralysis is peculiar in that at first it affects equally the entire limb, but in the course of a few weeks or months partial recovery takes place, and it is found that only groups of muscles or certain particular muscles are affected. This condition, however, usually persists for the remainder of life. Complete recovery is rare, and occurs only in cases originally of a slight character. The paralysis which remains affects most frequently certain muscles of the legs, more especially those on the anterior part, the extensors of the toes and the flexors of the foot; sometimes one leg or one arm is affected, and less commonly both legs; it rarely happens that the arm and leg of the same side are affected, or the arm of one side and the leg of the other. In some cases single muscles are affected, such as the extensor longus digitorum pedis, the tibialis anticus or the deltoid. The temperature of the affected parts is reduced by several degrees, and their electric contractility and reflex excitability are much diminished. In the course of a few months the paralysed muscles begin to waste. Various deformities manifest themselves as a result of the paralysis of the muscles; the various forms of club-foot developing after birth are for the most part due to this infantile paralysis. The bones and ligaments are often involved in the wasting, which goes on more rapidly than in progressive muscular atrophy. The knee-joint is seldom, if ever, the seat of distortion, but it sometimes becomes abnormally movable. The arm sometimes becomes contracted, owing to paralysis of the deltoid, pectoralis major or latissimus dorsi muscles. The contraction of the flexor tendons causes the fingers to become bent, but not to a very marked degree; the condition almost entirely disappears when the arm is allowed to hang down. Other distortions are connected with the vertebral column and shoulder joints. The electric contractility is diminished in those muscles which are slightly affected, but is lost in those completely paralysed. It sometimes happens that the faradic contractility is completely abolished, while the muscles will respond, though feebly, to the voltaic current. Sensation is not affected as a general rule; hyperæsthesia is present in some cases. The bladder and rectum are unaffected, and there is little or no tendency towards the formation of bedsores.

Diagnosis.—The rapid advent of the symptoms is a diagnostic sign. In cerebral paralysis the electric excitability of the muscles is not lost, and there is also an absence of wasting. On the other hand, cerebral paralysis is often accompanied by psychical disorder and paralysis of the muscles of the face or of the eye. Peripheral paralyses are distinguished by the impairment or loss of sensation with which they are associated. In hip-joint disease, the symptoms of which may simulate paralysis, there is pain in the knee and acute pain is produced by a blow on the heel, which causes the head of the femur to strike against the acetabulum. The temperature is also raised. Cases sometimes occur in adults, in which the symptoms resemble those of infantile palsy, the seats of the lesion in both cases being the anterior grey cornua. The symptoms are motor paralysis with preservation of the sensory function and of the functions of the bladder and rectum, loss of the electrical reaction and rapid wasting.

Prognosis.—The complaint seldom threatens life, but there is no prospect of restoration to health in severe or advanced cases. The paralysed muscles pass into a state of granular or fatty degeneration, and lose their electric contractility, and when these conditions are established recovery is hopeless. If on the other hand, atrophy has not set in, and there is some amount of faradic or galvanic contractility remaining, there is some ground for hope that at least partial recovery may take place.

Treatment.—When the symptoms supervene, cold should be applied to the spine, and be followed by mild counter-irritation.

The bowels should be kept open, and rest in the recumbent position must be strictly enjoined. As mentioned in the account of the symptoms, some portion of the paralysis usually subsides spontaneously in the course of time. Attempts should be made to cure or relieve what remains of this symptom. The most effective agent is galvanism. The continuous current may be first tried, one pole being applied to the spine and the other to the paralysed muscles, and this treatment should be persevered with for weeks or months. Local Faradisation may also be had recourse to. Warm baths, shampooing, passive movements and friction are all likely to be useful. In later stages, minute quantities of strychnia may be injected subcutaneously, and iodide of potassium may be given internally. Tonics of various kinds, especially iron, will probably be indicated. In some cases, the deformities due to the paralysis may be relieved by surgical operations.

ACUTE SPINAL PARALYSIS—POLIOMYELITIS ANTERIOR ACUTA.

This spinal paralysis occurs in the adult, the symptoms resemble those of infantile paralysis. It takes the form of motor paralysis, coming on rapidly and affecting the upper and lower limbs, or certain muscles or groups of muscles. The affected muscles are flaccid but well-nourished, and the cutaneous sensibility is retained. There is a rapid and marked loss of electric contractility. The control over the bladder and rectum is not affected. The paralysis may be complete or incomplete. It may be complete in the lower limbs and incomplete in the upper. The affection in adults is much more rare than the corresponding disorder in children.

Causes.—The disease most often occurs in persons between thirty and fifty years of age; and is generally attributed to undue exposure to cold and damp. Injuries, as wounds, fracture, or displacement of the vertebræ from any cause, may lead to it. In the advanced stages of acute spinal meningitis and myelitis, paralysis is frequently observed. Acute fevers are occasionally followed by symptoms of paralysis.

Symptoms.—The disease generally sets in without warning; any premonitory symptoms are for the most part very slight. The patient while walking perceives weakness in one or both legs; this feeling becomes more marked, and especially in the flexor muscles. Pain in the back is perhaps felt, and the patient soon finds himself unable to walk; when in bed he only feels that he has no power in his legs. The arms are likewise affected, but generally to a less extent. Patellar reflex is absent. There are no tremors, no convulsive spasms, and no loss of power of co-ordination. There is no impairment of sensation. Under strong Faradic currents, the paralysed muscles of the legs slightly contract; those of the arm fairly respond: with the galvanic current, the muscles do not respond at all. The temperature of the affected parts is lowered. The paralysis sometimes more or less rapidly extends over the trunk, and in a few days may spread over the whole body. A form of the disease has been described as "acute ascending paralysis." In this latter, the paralysis gradually spreads to the head and neck, and sometimes involves the muscles supplied by the motor nerves of the medulla oblongata. Deglutition, respiration, and articulation are then affected. The disease runs its course without fever.

Terminations. — Where death takes place, it is usually from asphyxia, due to implication of the medulla oblongata. Except in the acute ascending form, recovery frequently takes place. The duration varies from a few weeks to several months or years. The longer the symptoms last, the less likely is recovery to take place.

GENERAL SPINAL PARALYSIS.—When due to inter-meningeal hæmorrhage in the cervical portion is generally fatal in a few hours. It is characterised by the sudden occurrence of the symptoms. The patient falls down, as if in a fit, but there is no loss of consciousness. He complains of severe pain in the neck, arms, and shoulders, and there are muscular spasms or tremors. The paralysis is complete, and may be sensory as well as motor. It affects both upper and lower limbs. There is also paralysis of the muscles of respiration, giving rise to dyspnœa; and deglutition is painful and difficult. Death takes place from apnœa. When due to hæmorrhage within the cervical portion of the cord, the paralysis is sudden and complete, but unattended with any muscular spasm or tremors. This form is equally fatal, death taking place in a very few hours. General spinal paralysis also occurs in persons suffering from spinal pachymeningitis. The inflammatory products or extravasations are deposited either externally or internally to the dura mater. Some cases are due to caries of the vertebræ in the cervical region. Pain in the neck is complained of, and paralysis of the upper and lower limbs rapidly supervenes. The fingers soon become spasmodically clenched and appear claw-like; the paralysed muscles speedily become atrophied and are the seat of spasms and tremors. There is impairment or loss of Faradic excitability.

Prognosis.—This must depend upon the opinion formed as to the nature of the lesion to which the symptoms are due. Complete recovery may be looked for in some cases; in others, only partial, with more or less atrophy is all that can be expected.

Treatment.—General spinal paralysis when not due to injury or any traumatic cause, generally progresses favorably. The indications are:—1. To maintain the nutrition in the nerves and muscles affected. 2. To prevent atrophy or degeneration. 3. To preserve or to restore the functional activity to the paralysed parts. Endeavours should be made to attain these objects by administering nutritious diet, by placing the patient under favorable conditions of hygiene, &c., and prescribing medicines which promote or invigorate the state of general health. To prevent atrophy and degeneration, various mechanical means, as friction, shampooing and passive movements, are indicated. Belladonna, in doses of from ten to twenty minims of the tincture three times a day, has been given with good results in a few cases. Strychnia, which is highly beneficial in some forms of paralysis, has failed entirely in this affection. To maintain muscular nutrition, localised electrisation is of immense benefit. By the application of Faradic electricity the muscular contractility is excited, and it thus tends to develop functional activity in those muscles which do not respond to the will.

SPASMODIC SPINAL PARALYSIS—IDIOPATHIC LATERAL SCLEROSIS—SPASMODIC TABES DORSALIS.

This affection of the spinal cord has been particularly described by Dr. Erb, of Heidelberg, and Professor Charcot. It somewhat resembles locomotor ataxy; the epithet "spasmodic" is employed to designate the most marked clinical symptom. It is characterised by permanent contraction of the limbs, gradually increasing, and sooner or later rendering them powerless, without the coexistence of any marked disturbance of sensation.

Causes.—Males are more liable than females to this disease, which is most apt to occur between thirty and fifty years of age. Children, however, are sometimes affected. In some of the cases reported to have occurred in children, the symptoms were probably due to a primary cerebral lesion. As a general rule, no cause can be assigned; but injuries, such as falls, and exposure to wet and cold, may perhaps have some effect in producing the disease.

Anatomical appearances.—Very few investigations have been made. In one case, recently examined by Dr. Dreschfeld, the spinal cord, except in the lower dorsal region, appeared normal to the naked eye. After hardening in bichromate of ammonia, sections of the cord showed to the naked eye one light-coloured patch in each lateral column in all the regions of the cord. This band of morbid tissue presented the characters of a sclerosis, and occupied the greater portion of the lateral columns, but did not involve the grey matter or extend to the surface of the cord. The anterior and posterior columns were perfectly healthy. Microscopical ex-

(2) the grey substance in the same portions of the nerve-centres; (3) the anterior roots of the spinal nerves, and (4) the muscles.

Symptoms.—Diminution of motor power is first observed in the upper extremities, which soon present indications of atrophy. Neither the weakness nor the wasting is limited to any particular muscle or set of muscles, but the emaciation of the limb is of a general character. Fibrillary twitchings are also noticed. The Faradaic contractility is unaltered, unless the atrophy be very profound. After a while the muscles become rigid, and various deformities due to contractions are noticed. The hands are clenched; the forearms pronated; the wrists flexed and turned outwards; the arms are fixed close to the side of the chest. Any attempt to alter the position of the parts causes pain. All these symptoms come on within a few months. Some power of motion may remain, but any effort to move the limb is only partially successful and always induces twitchings. Sometimes both upper extremities are affected simultaneously, but more frequently one arm is first attacked, and soon afterwards the other. After an interval, varying from two to nine months, the lower extremities become similarly affected. Gradually increasing paresis; exaggerated tendon-reflexes; rigidity; difficulty of motion followed by inability to stand are the prominent symptoms. The muscles, deprived of voluntary motion, become spasmodically contracted; a condition of tetanic stiffness sometimes becomes developed, so that the legs resemble a bar of wood. They are also the seat of convulsive twitchings. Atrophy sooner or later sets in, but is later in appearing than was the case in the upper limbs, and the patient becomes quite helpless. In some cases the lower extremities present but slight traces of atrophy, and in this respect contrast very decidedly with the upper limbs.

The third period of the disease is marked by the occurrence of symptoms due to extension of the morbid process in an upward direction. Signs of paralysis of the lips, tongue, and larynx make their appearance. The muscles of the lips and tongue become obviously atrophied; deglutition is difficult, and articulation is more or less impeded. Paralysis of the palate gives rise to nasal voice, and the same condition of the orbicularis oris alters the appearance of the features. Finally, the nuclei of the pneumogastric nerve become involved, respiration and circulation are consequently embarrassed, and death results. Sometimes the phrenic nerve is also involved. The bladder and rectum are not affected, and there is no decided tendency to the formation of bedsores. There is also no anæsthesia.

Diagnosis.—The symptoms as detailed above are characteristic of the disease, and there is no difficulty in distinguishing it if attention be paid to its mode of origin and the course of the symptoms, especially the implication of upper parts of the spine and medulla oblongata.

Prognosis.—This must be of a very gloomy character; there is no case on record in which recovery took place.

Treatment.—The remedies suggested for spasmodic tabes may be tried, but success is not to be expected. Every effort should be made to improve the general health.

MULTIPLE SCLEROSIS OF THE SPINAL CORD—DISSEMINATED SCLEROSIS—MULTILOCULAR SCLEROSIS—INSULAR SCLEROSIS.

Disseminated sclerosis is found mentioned for the first time in Cruveilhier's 'Atlas of Pathological Anatomy' (1842), but it is only since 1862 that the peculiar characters of the symptoms to which it gives rise have been properly recognised. It is not an exclusively spinal affection, inasmuch as cases occur in which the cerebrum, the pons Varolii, the cerebellum and the medulla oblongata are likewise implicated. Sclerosed patches, of various sizes and shapes, are found throughout the spinal cord and in different portions of the brain, and the symptoms vary according to the position, stage of development, and size of these patches. Three different forms are met with: in the first, the morbid changes occur in the spinal cord alone; in the second, in the cerebrum alone; in the third, both the brain and the spinal cord are affected. The three forms may thus be designated *spinal*, *cerebral*, and *cerebro-spinal* respectively. The main clinical symptoms are: paralysis of the lower, followed by that of the upper extremities; tremors and other involuntary movements of the paralysed muscles; paralysis of the muscles of the trunk, neck, tongue, and lips; rigidity of the paralysed muscles; difficulty of articulation; apoplectiform or epileptiform attacks and various indications of derangement of the mental faculties.

Causes.—But little that is definite can be stated. Disseminated sclerosis is rather more common in females than in males, and the patients are generally between twenty and thirty years of age. It is said to be very rare after forty. Exposure to wet and cold, blows and falls and other similar injuries, mental excitement and shocks, great bodily fatigue and various severe diseases are known to have preceded the advent of the symptoms in some cases. Severe neuralgia and hysteria are said to predispose to it.

Anatomical appearances.—On the surface of the spinal cord and on making sections in various directions, greyish patches are visible, having a more or less regular outline but quite distinctly circum-

Affection of the eyes.—Impaired vision and double vision are common in the early stage, but blindness is rare. Nystagmus is a prominent symptom, and consists in horizontal, rotatory or oblique oscillations of the eyeballs, especially marked when the patient begins to stare at a fixed object. There are no signs of hyperæmia of the eyeball, and no squint. The pupils are widely dilated and not sensitive to light. The ophthalmoscope often reveals atrophy of the optic nerve.

Defective hearing and speech.—Imperfect articulation is a constant symptom. There is a pause after each syllable, and the words are pronounced imperfectly and in feeble tone. The lips and tongue tremble during speech. These symptoms are due to paralysis of the vocal cords, resulting from implication of the medulla oblongata.

Vertigo is an early symptom and generally occurs in short paroxysms; it is sometimes continuous.

Loss of motion.—The patient feels one lower extremity weak, heavy, and drags it in walking. Soon the other leg follows, and the weakness then extends to the arms. There is sometimes tingling or numbness and slightly impaired sensibility of the skin. There is in the early stage no paralysis of the bladder or rectum, no wasting of the paralysed limbs, and reflex and electric contractility are unimpaired. In advanced cases there is great wasting of muscles. The paralysis is followed by contraction and rigidity, which become a marked symptom in the later stages.

Condition of the mind.—The face is vacant; the aspect sad; the mind and intellect impaired; the patient maniacal or demented, laughing or crying, or stupid and dull. Some patients are very irritable and fretful and resent being touched, and often frown and scream even when no one is near them. Apoplectiform or epileptiform attacks sometimes occur.

With regard to the general order of their sequence, the symptoms above detailed can be divided into three periods:—The first period extends from the commencement to the rigidity of the muscles. In the cerebral form the symptoms begin with vertigo or with double vision, which is soon followed by convulsions and embarrassed speech. In the spinal form paresis of one lower extremity is the first symptom. The progress is very slow and the condition may last for many years, when the second period sets in with further aggravation of these symptoms, and the patient is now bedridden. In this period there is rigidity of the limbs, but the organic functions are not affected. The third period is that of deranged organic functions. The appetite fails, emaciation follows, diarrhœa sets in, bedsores form over the trochanters, the sphincters cease to act, and the case ends in death.

Duration.—The disease may last for five, ten, or even twenty years, during which time nutrition and appetite continue unimpaired. Death may be due to intercurrent disorder, to apoplexy, to asphyxia, to inflammation of the bladder and kidneys, to bedsores or general failure of nutrition. The progress is very slow, and several years may pass before the second period sets in, with further aggravation of the symptoms.

Diagnosis.—When the morbid process begins in the cerebrum there is at first nothing very distinctive about the symptoms. The diagnosis is easier when the first symptoms are those of the spinal form. The appearance of the weakness in one limb; its increase and extension to the other side; the peculiar tremors and the manner in which these are excited and increased are diagnostic signs. There is also the unimpaired sensibility and electrical irritability as negative symptoms. The differences between the symptoms of multiple sclerosis and those of chorea and paralysis agitans have been already given. It must be remembered that varieties sometimes occur in which the symptoms are complicated and obscure.

Prognosis.—When the symptoms are such as to leave no doubt as to the nature of the disease, the prognosis is very gloomy. Life may doubtless be prolonged by proper care and treatment.

Treatment.—There is little to be said under this head. The patient should be made as comfortable as possible, and the condition of his general health very carefully attended to. Good nourishing food, fresh air, warm baths from time to time, and careful nursing are especially indicated. Nitrate of silver has been given with advantage in the early stages. The iodide and the bromide of potassium should always be tried, and may be combined with arsenic, cod-liver oil and other tonics. Phosphide of zinc is said to diminish the violence of the tremors. Friction to the limbs may give a little relief, and various anodyne liniments may be used for this purpose.

MORBID GROWTHS OF THE SPINAL CORD AND ITS MEMBRANES.

Small cartilaginous and bony plates attached to the arachnoid are sometimes found as a result of inflammation of the membranes of the cord. Medullary cancer, tubercle, syphilitic gummata, hydatid cysts and aneurisms within the vertebral canal are extremely rare.

Symptoms.—These are due to the mechanical irritation; to the pressure upon the cord and the consequent atrophy or destruction; to local inflammation and to the interruption of the communication between the brain and the peripheral nerves. The tumours originate scribed, and contrasting in a marked manner with the adjacent portions. These patches are sometimes discrete and sometimes confluent, and are distributed in no particular order in the substance of the cord. Similar patches are found in the medulla oblongata and in the encephalon. In the *spinal cord* the spots are often seen through the pia mater, and they assume a rosy tint or salmon colour on exposure to the atmosphere. They are found in all the regions of the cord; they invade the different columns indiscriminately, and attack the grey substance as well as the white. In the *brain* there is rarely any change of colour on the surface, for the patches are almost always confined to the central portions. Here they invade especially the walls of the ventricles, the white substance of the centrum ovale, the septum lucidum, the corpus callosum, the optic thalami and corpora striata. In the *cerebellum* the patches are generally in the interior, no change being visible externally. In the *pons Varolii* and *medulla oblongata* the patches are both peripheral and deep-seated. In the pons they generally occupy its antero-inferior aspect, and they may extend into the corpora albicantia and the crura cerebri. In the medulla oblongata the patches are found to affect, either singly or together, the olivary bodies, the pyramidal bodies, and the posterior region where the nuclei of origin of the bulbar nerves are disposed. Various *nerves* are often affected; sclerosed patches are found in their course; but nerves emerging from sclerosed patches are sometimes found to be perfectly sound. The *optic*, *olfactory*, and the *fifth* pair are the cranial nerves most frequently involved. Patches have been observed on the anterior and posterior roots of the spinal nerves.

The sclerotic patches vary in size from that of a small pea to that of a hazel nut. They are rounded, and resemble grey matter; they often project above the general level, but are sometimes depressed below it. They have a firm consistence, and on section present a clean surface covered by more or less transparent fluid. Under the microscope each patch consists of three zones. In the outermost the neuroglia and the nuclei are increased in size and number, but the nerve-tubules are diminished in calibre on account of the partial disappearance of the white substance of Schwann. In the next zone, the neuroglia is still more increased, the nerve-tubules are more widely separated, and much more diminished in size, and the white substance has completely disappeared. In the central zone the neuroglia is still more abundant, and the nerve-tubules and even nerve-cells have disappeared. The walls of the capillaries, as well as of the arteries and veins, are generally much thickened.

perhaps when the growths are due to syphilis. In these cases, large doses of iodide of potassium (100 or more grains daily) have occasionally produced good results.

TABES DORSALIS—LOCOMOTOR ATAXY.

The disorder is characterised by diminution of sensibility and motor power, not as in paralysis, but manifested by want of co-ordination of muscular movements in the performance of voluntary acts. Co-ordinate voluntary movements are illustrated by the action of the hands in grasping objects, and of the lower extremities in walking. In ataxia the movements, although voluntary, are incoordinate and not completely under the control of the will. The condition is also known as tabes dorsalis. Ataxia signifies want of proper place or order. During health co-ordination involves two kinds of muscular action. The first requisite is harmonious action of all the muscles taking part in any motion. In the second place, the antagonistic muscles must be relaxed sufficiently, and at the right time. The voluntary muscles should contract properly, that is, neither too quickly nor too slowly, nor too much nor too little. In ataxy the muscles contract too much or too little, too rapidly or too slowly, or else the antagonistic muscles do not relax enough, or at the right time. The power of co-ordination is diminished or lost, although considerable motor power may still remain.

In confirmed cases we find apparent motor paralysis of the lower extremities; the patient experiences great difficulty in walking when his eyes are shut, or if the room is dark. On placing his feet on the ground he feels as if he were standing on down or soft sand.

Causes.—These are obscure. In a few cases hereditary predisposition can be traced. Syphilis is perhaps a common cause; at any rate, there is a history of this disease in a large proportion of the cases. Ataxy is sometimes attributed to exposure to cold or wet, and to bodily fatigue or injury. Exposure to damp and cold when overheated is a possible cause of ataxy. It is sometimes attributed to sexual excesses and to onanism. Suppression of habitual perspiration and the removal of hæmorrhoids have preceded the advent of the disease in some cases. It occurs most commonly between thirty-five and fifty years of age. Children and very old persons are exempt from it. It is more common in men than in women, and is sometimes associated with epilepsy and insanity.

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Prognosis.—When the symptoms are such as to leave no doubt as to the nature of the disease, the prognosis is very gloomy. Life may doubtless be prolonged by proper care and treatment.

Treatment.—There is little to be said under this head. The patient should be made as comfortable as possible, and the condition of his general health very carefully attended to. Good nourishing food, fresh air, warm baths from time to time, and careful nursing are especially indicated. Nitrate of silver has been given with advantage in the early stages. The iodide and the bromide of potassium should always be tried, and may be combined with arsenic, cod-liver oil and other tonics. Phosphide of zinc is said to diminish the violence of the tremors. Friction to the limbs may give a little relief, and various anodyne liniments may be used for this purpose.

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Symptoms.—These are due to the mechanical irritation; to the pressure upon the cord and the consequent atrophy or destruction; to local inflammation and to the interruption of the communication between the brain and the peripheral nerves. The tumours originate in one of three localities. Some grow in the substance of the cord, others have their origin in the meninges of the cord, while a third variety are developed between the vertebræ and the membranes. The first form gives rise to compression and destruction of the cord, and leads to paraplegia and anæsthesia of the lower part of the body. The paralysis varies as the tumour is situated higher or lower in the cord, or according to the tract it involves. Tumours generally originate in the grey matter, and hence, when they exist they affect both motion and sensation and are rarely accompanied with either central or peripheral pain. When they involve one side, or a limited portion of the cord, they induce irregular or cross paralysis; thus, in the early stage motor paralysis on the side of the lesion and sensory paralysis on the opposite side are sometimes observed. In advanced cases they produce absolute paraplegia. They also give rise to degenerative changes, to contractions of affected muscles, and to their rapid wasting. The second variety of tumours, those arising from the membranes, may involve the roots of either sensory or motor nerves; hence, at first there may be twitchings, followed by paralysis and rapid wasting of muscles. In this variety there may also be agonising pain limited to a certain spot, or the pain may be shooting and accompanied by skin eruptions as herpes along the course of the affected nerve. Aneurisms and malignant tumours are generally of the third variety, and extend to the meninges and the medulla. They involve the motor and sensory nerves in the neighbourhood of their origin, and are therefore attended by severe, constant, and increasing pains, increased sensibility of the skin, erythematous eruptions, and rapid wasting and contraction of the paralysed muscles. All these growths, when they attain a considerable size, may fill the spinal canal, and after destroying the vertebræ, may even extend outwardly until they invade the skin. Tubercles may be suspected in any given case if they are evidently present in other organs, and if paraplegia be a prominent symptom it is more probably due to tubercles than to any existing caries of the vertebræ. Tubercles form yellow nodules, and are usually met with in the cervical and lumbar regions. If syphilis be present, and if paraplegia supervene, gummata may be suspected. If, before paralysis sets in, there is a severe pain, it may be due to a tumour in the vertebræ; and if at the same time cancer exists in other parts, malignancy may be suspected. In tumours, as a general rule, the paralysis does not begin at the same time on both sides, as is usually the case in chronic myelitis.

Treatment.—The same as in tumours in the brain. The pain may be relieved by anodynes, as morphia or atropia, hypodermically injected. Little, however, can be expected from treatment, except perhaps when the growths are due to syphilis. In these cases, large doses of iodide of potassium (100 or more grains daily) have occasionally produced good results.

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Causes.—These are obscure. In a few cases hereditary predisposition can be traced. Syphilis is perhaps a common cause; at any rate, there is a history of this disease in a large proportion of the cases. Ataxy is sometimes attributed to exposure to cold or wet, and to bodily fatigue or injury. Exposure to damp and cold when overheated is a possible cause of ataxy. It is sometimes attributed to sexual excesses and to onanism. Suppression of habitual perspiration and the removal of hæmorrhoids have preceded the advent of the disease in some cases. It occurs most commonly between thirty-five and fifty years of age. Children and very old persons are exempt from it. It is more common in men than in women, and is sometimes associated with epilepsy and insanity.

Morbid appearances.—These are a peculiar or grey degeneration of the posterior columns of the spinal cord. The degeneration is bilateral and gradually increases till it invades the entire extent of these columns. Some believe the degeneration to be due to chronic inflammation. In this lesion the posterior spinal nerves are also implicated, hence besides impaired co-ordination there is impairment of muscular and cutaneous sensibility. The degeneration begins in the vicinity of the posterior fissure, and then spreads towards the sides and to the grey commissure. Both columns are symmetrically affected, the lower part of the cord or the dorsal and upper lumbar more than the upper or the cervical portion. The anterior roots of all the nerves are normal. Some pathologists assert that in many cases the posterior pyramids are found to be tolerably healthy; that the derangement of the functions of the cord is due to some molecular changes of these parts that cannot be readily discovered; that the degeneration is only found in a band of white matter between the posterior pyramid of the cord and the posterior roots of the nerves with the adjacent part of the posterior cornu of the cord. At first the diseased portion is grey or greyish-red, somewhat translucent and soft. When induration occurs, the portion becomes less transparent and shrinks. The morbid change consists of atrophy and disintegration of the nerve fibres, and hypertrophy of the connective tissue and the presence of corpora amylacea. Many of the blood-vessels are surrounded with oil-globules. Under the microscope, the degenerated part is found to consist of a few atrophied nerve filaments, atrophied cells, and nucleated connective-tissue elements, a few granule cells, molecules of fat and many corpora amylacea. The cord appears flattened from before backwards, and broader than normal. The increase in size is only apparent, as there is diminished bulk of the affected columns. The dura mater is either normal or its posterior half slightly thickened; the arachnoid is moderately opaque; the pia mater is thick and adherent to the posterior columns. Sometimes all the membranes are much congested, thickened posteriorly by exudations, and adherent to each other and to the posterior columns.

Symptoms.—The disease is progressive. It is occasionally sudden in its onset, and there is from the first want of co-ordinating power with apparent paralysis. In a majority of cases its development is insidious, and the primary symptoms continue to increase for months or even years before the ataxic movements are established. In some cases neuralgia is one of the earliest precursory symptoms. The patient feels paroxysmal, momentary shooting pains, resembling those caused by electric shocks, in the course of the nerves of the lower extremities. The severity of the pain may be great or very slight. In other cases the first symptom noticed is disturbance of sensory power, as evidenced by inability to walk short distances without great fatigue. The patient feels his legs too heavy for him to lift without great effort. The pains are probably due to morbid excitement of the posterior roots, and the disturbance of sensibility or the feeling of fatigue also depends on hyperæsthesia or morbid excitability of the sensory muscular nerves. Other symptoms also refer to disturbed sensibility, and include numbness, formication, and a feeling as if there were some constriction round the waist or abdomen. Erythematous or vesicular eruptions often appear over the course of the affected nerves. The pain in the limbs is deep-seated, as if in the bones, and there is aching in the back and joints. The constrictive pain is generally permanent; the others are temporary and often recur. The patient is generally restless at night. In many cases the viscera are implicated, and there is often painful and frequent micturition, also pain in the urethra, and painful defæcation; the heart may become deranged, the stomach is disordered, and there may be vomiting and gastric pain. Sometimes the stomach-pain is paroxysmal, and it may be so severe that the patient faints. Temporary disorder of vision and impotence, with marked desire for sexual intercourse, are also liable to occur at this period.

When the disease is established the ataxic phenomena become more marked. The power of co-ordination is diminished or lost. There is more decided difficulty in walking. There is no actual loss of motor power, but the patient cannot walk any distance without fatigue. The loss of co-ordinating power is shown by the limbs being thrown forwards in an irregular jerking manner, while the feet strike the ground heavily and with much force. The patient cannot walk steadily without the aid of his eyes. While rising from his seat, or while turning suddenly on his heels and when walking in the dark, he slips about and has an uncertain gait. His movements become tumultuous, he cannot stand erect on his feet when blindfolded. His features betray anxiety and effort in walking to make a beginning. He has difficulty in starting, and when requested he pauses for a while to balance himself, and then starts at once with body bent forwards and legs apart. He is also powerless to arrest his own progress suddenly, or to turn round. Gradually every movement becomes tumultuous, and while walking he has to pay increased attention to the movements of the lower extremities. The feeling of constriction round his waist as if a cord were tied tightly round it is a marked feature in some cases. The sensibility is diminished or permanently lost in both lower extremities. If the legs are pricked, no response is made for some time. The paralysis may extend upwards to the cranial nerves, and there may be loss of sensibility in the course of the fifth nerve, and paralysis of the third and sixth nerves. There may be diplopia or external or internal squint or ptosis, or the pupils are extremely contracted or sometimes unequal. Disorders of vision are frequent. The patient may see properly and distinguish small objects or the colour of objects; he may recognise yellow and blue, but fails to distinguish red and green; very often he sees with only one eye. In a few cases there is complete blindness or amaurosis, due to atrophy of the optic nerve. Under the ophthalmoscope the disc looks chalky and opaque, the margin has lost its redness, and the retinal vessels are empty and thin in calibre, and appear to terminate abruptly. This atrophic condition is the result of sclerotic changes in the optic tract, due to the extension of sclerosis from the posterior columns of the cord. The atrophy sometimes extends as far as the corpora quadrigemina. All these symptoms often disappear and recur. They are rarely permanent until some time has elapsed.

Besides the disturbed vision, there are observed frontal and occipital headaches and pain in the course of the fifth nerve and its ramifications. Deafness occurs in some cases. Certain joints, especially the hip and knee, become swollen with little or no pain; sometimes they recover, sometimes they undergo disorganisation. The pulse is said to be frequent and dicrotous. After a time when the symptoms become fully established, the patient becomes very unsteady in his movements, he cannot walk, but only staggers, and advances precipitately; and in trying to walk lifts the foot up to an unnecessary height in the air, then throws it forwards and outwards, and brings it down with a heavy stamp. The arms are equally affected; there is unsteadiness in picking up anything, and he requires the use of both hands to catch hold of an object, or the movements are very clumsy. Even in very severe cases there is no true motor paralysis. A characteristic symptom of ataxia is the inability to stand with the heels in apposition and the eyes closed. When this attempt is made, the patient reels and falls to the ground if not supported. Very frequently the patient, though bedridden, can freely move his legs while in bed or sitting, which is never the case in paraplegic paralysis. In ataxia the muscles do not waste. The reflex excitability and electro-muscular contractility are both impaired, and differences of heat and cold are imperfectly perceived. The patellar reflex movements are often wanting. Striking the patellar tendon just below the bone does not cause jerking movement of the leg as in health. Such patients are generally impotent, and they often report abnormal excitability of the genitals previous to the attack. Ultimately general emaciation sets in, and death takes place from exhaustion, consumption, or from some complications, as erysipelas, bronchitis or pneumonia.

The disease is sometimes associated with spinal paralysis. This is due to the extension of the lesion to the lateral columns.

Prognosis.—Where the disease is diagnosed early, its progress may be retarded for many years, and even recovery may follow. The disease often remains stationary for a long time. When the symptoms are well marked the prognosis is highly unfavorable. Temporary improvement may occur, but the symptoms invariably return in an aggravated form. Death may be due to complications, as paralysis of muscles of deglutition or of respiration; to cystitis, disease of the kidneys, or to bedsores.

Diagnosis.—Locomotor ataxy may be confounded with *chronic myelitis; disease of the cerebellum; softening of the brain; general cerebral paralysis; paralysis agitans*, and *chronic alcoholic poisoning.*

In chronic myelitis there is paralysis, and the symptoms are referable to inflammation. There is fixed pain, increased by pressure, at a certain point in the back. There are muscular spasms, diminished electric contractility, and atrophy of muscles. In disease of the cerebellum there is often fixed and permanent pain in the back of the head and vertigo. The difficulty of walking is due to vertigo, and the gait is like that of a drunken man. In ataxia there is double vision, or strabismus which may come on from the first and may often disappear. In disease of the cerebellum the eye-affection comes on late and continues longer. In cerebellar disease there may be vomiting and convulsions, but these are not present in ataxy. In both there is impulse to rush forwards or backwards, and the patient cannot maintain his equilibrium. There is no true ataxy of co-ordination in cerebellar disorders. In softening of the brain there is impaired memory and intellect at an early period, and often there is hemiplegia. Where ataxia has progressed so far as to involve the upper limbs, the incoordinate movements may be mistaken for tremors, such as occur in alcoholic poisoning, in paralysis agitans, and multiple sclerosis.

In alcoholic poisoning the history of the case and the odour of alcohol will establish the diagnosis. In paralysis agitans and in multiple sclerosis the tremors involve the arms and legs, and in the latter affection they occur only when the muscles are in use. Ataxy is sometimes confounded with general cerebral paralysis, and with progressive muscular atrophy. The former is ushered in by cerebral symptoms, as delirium or convulsions, followed by hemiplegia, and the disorder of motility is purely paralytic, but not ataxic. The muscles become rigid, and there is no tendency to atrophy or deformity.

Progressive muscular atrophy usually begins in the upper extremities, and only rarely in the lower limbs. Special groups of muscles of the forearm and arm are most commonly affected. The muscles lose their vigour and either become thin, or undergo fatty degeneration and retain their volume. Fibrillary contractions are followed by permanent contractions and deformities. Pain is sometimes felt in the muscles, but there are no symptoms of true ataxia.

Treatment.—In locomotor ataxy, attention must be directed towards the improvement of the ataxic condition. The cause must be sought for and its further effects avoided. Excesses of every kind are to be strictly forbidden. Attempts should be made to improve the state of general health by careful attention to the diet and hygiene. The patient should be protected from cold and wet and kept in an equable temperature. Sulphur baths have been found efficacious. For the relief of the neuralgic pains, anodyne liniments, sinapisms, and dry cupping are sometimes beneficial. The remedies which have found most favour in locomotor ataxia are various preparations of silver, zinc, and phosphorus. The chief and most useful salts of silver are the oxide and the nitrate. They should be tried for about six weeks. The dose of the nitrate is gr. one-eighth, gradually increased to gr. j three times a day. Silver is supposed to act by its modifying influence on the nutrition of the nervous system. Phosphorus may be given in the form of phosphide of zinc, or of hypophosphite of soda, or in an oleaginous solution.

The constant current of electricity has been much praised by some physicians. One pole may be placed on the spine and the other applied to the limbs; or both poles may be applied to the spine. The use of electricity may be combined with that of phosphorus and nitrate of silver. Other remedies recommended are ergot, turpentine, arsenic, strychnia, and chloride of barium. Where there has been a history of syphilis, iodide of potassium has sometimes cured the ataxy. Bromide of potassium gives relief to the shooting pains which cause great suffering. Vomiting and other abdominal symptoms are relieved by opium. Constipation when present requires mild purgatives, as aloes combined with belladonna. Rest of body and mind, and a fair quantity of animal food and stimulants are necessary adjuncts to the medicinal treatment.

PROGRESSIVE MUSCULAR ATROPHY—CRUVEILHIER'S ATROPHY—WASTING PALSY.

These terms have been applied to two paralytic affections. In one the muscles are from the first subject to progressive wasting, and in the other to pseudo-hypertrophy. In both cases the power of the muscles is subsequently lost. The term "progressive muscular atrophy" is now applied to designate an affection the essential feature of which is a slowly progressive wasting of the voluntary muscles, ending in complete destruction of their functions, very rarely curable, and in many cases leading to death. The disease is generally primary; but it may be secondary to other spinal diseases, as locomotor ataxia, sclerosis of the lateral columns, or to central myelitis.

Causes.—It occurs most commonly in males from twenty-five to thirty-five years; it rarely occurs in children. It appears in some cases to be hereditary. The onset of the symptoms has been attributed to wet and cold, to violent strain of certain muscles, and to excessive bodily or mental fatigue. Syphilis, and diseases and injuries of the spine have also been adduced as causes of progressive muscular atrophy.

Pathology.—The disease is connected with chronic inflammatory changes in the nerve-cells, and their processes in the anterior cornua of the spinal cord, although some observers think that it may have its origin in the muscles themselves. The parts affected are the grey matter of the anterior cornua of the cord, and also the roots of the motor nerves which emerge from it. The alterations are of various kinds; pigmentary degeneration takes place at the beginning, and in severe cases the nerve-cells completely disappear. The blood-vessels are much dilated. The affected cells are not motor cells, but those which supply nutrition to the muscles of the trunk and limbs, and hence there is no motor paralysis. The affected muscular fibres are in a state of simple wasting or of granular or fatty degeneration. The muscle is soft, pale, and yellowish, and its consistence is greater than natural, owing to the growth of connective tissue between the fibrils. Its volume is considerably lessened. This diminution in size, however, is not in proportion to the atrophy inasmuch as the fibroid tissue and fat granules take the place of the muscular substance. Under the microscope, the transverse and longitudinal striæ are found to have disappeared, and in advanced cases the muscular tissue is represented only by granules, soluble in acetic acid. Fatty degeneration is also seen, and many fat-cells are found between the fibres, and these may increase in proportion as the muscular tissue wastes. Waxy or vitreous degeneration is not unfrequently found.

Symptoms.—The disease sets in insidiously, and there is no constitutional disturbance; the affection is known by the wasting, diminution of volume, and loss of power of the voluntary muscles, with no impairment of the general sensibility or of the mental faculties. In a majority of cases the muscular atrophy commences in the upper limbs and more often on the right than on the left side. It begins either in the ball of the thumb or in the interossei muscles, then extends to the muscles of the hand, forearm, and arm, and from these to the shoulder and back. It gradually advances in some cases to every voluntary muscle of the body, except the muscles of mastication and of the eyeballs. The atrophy rarely begins in the lower limbs; thus the affection differs from locomotor ataxia. The muscles of the trunk generally escape. The wasting of the muscles of the thumb and the interossei muscles causes the hand to present an appearance resembling a bird's claw. Gradually the wasting extends to the muscles of deglutition and respiration, and there is inability to swallow or to breathe. The wasting of the muscles gives rise to various distortions; the shoulders droop, and the hands hang aimlessly at the sides; the atrophied muscles have a soft flabby feel, and in advanced cases the atrophied limbs seem to be mere bone and skin. When this disease attacks young children, it begins with atrophy and subsequent effacement of the facial muscles, causing the countenance to look vacant. The disease is often symmetrical, the limbs on both sides becoming simultaneously involved. The reaction of the muscles to electricity is peculiar. The contractility of the wasted muscles is at first slightly diminished; but until the atrophy is well-nigh complete the muscles respond in some degree to both currents. The loss of contractility is in proportion to the degree of atrophic changes. Sometimes there is a remarkable quivering of the affected muscles, or a sort of fibrillar twitching which can also be produced by gently tapping the surface. In many cases the fibrillar twitchings occur spontaneously. The vibrations can be seen or felt as if various threads were vibrating more or less rapidly. The mind is clear, the judgment remains sound. Notwithstanding the severity of the affection, the general health continues good, unless there is paralysis affecting the muscles of deglutition and respiration. In this disease there is no loss of power over the bladder or rectum. There is lowering of the temperature of the diseased limb, absence of pain, no tendency to bedsores or cutaneous eruptions. The paralysis is due to the wasting of the muscles, which also induces some amount of incoordination.

Diagnosis.—This is for the most part easily made. The insidious invasion; the intense atrophy in a certain number of muscles in an upper extremity; the advance of the atrophy, to a certain extent muscle by muscle, to other parts of the body, are distinguishing characteristics. Moreover, the debility depends upon the atrophy of the muscles, and contrasts strongly with paralysis properly so called. Other peculiar symptoms of progressive muscular atrophy are the fibrillary twitchings and quiverings, and the deformities due to the distribution of the atrophy. The response yielded by the muscles to faradisation also distinguishes this form of atrophy from post-paralytic wasting.

Prognosis.—The duration of the disease may be prolonged for many years, and in some cases the atrophy is confined to the muscles of the hands for a lengthened period. As long as the disease is confined to the extremities there is some hope of recovery. Death generally occurs from exhaustion and asphyxia, owing to the muscles of deglutition, the diaphragm and the intercostal muscles becoming involved. The fatal result may be hastened by the occurrence of labio-glosso-laryngeal paralysis, or it may be due to intercurrent complications.

Treatment.—As the disease sometimes arises from fatigue and excessive use of the muscles, rest is essential. It is also of considerable importance to increase the functional activity of the remaining healthy muscular fibres within the affected muscles. For this purpose, passive motion and electricity are useful aids. The electricity should be applied to the affected muscles, those most important to life being first attended to. The continuous and the interrupted currents should be used in turn; in some cases the muscles respond to the one form better than they do to the other. The continuous current should also be applied to the spinal column, especially in the cervical region. It is necessary in this, as in every similar ailment, to improve the state of the general health by nutritious diet, tonics, fresh air, &c. Warm clothing and warm baths are also likely to be useful. The treatment by electricity should be pushed to the full extent, and if no good result be at first produced, stimulation for a longer time and with a more intense current should be used, with shorter intermissions. The sitting, however, should not extend beyond fifteen minutes, and one minute should be allowed to each muscle. Pain may be relieved by fomentations: some recommend the internal administration of nitrate of silver in these cases, and they assert that the sense of touch under its influence becomes more acute, the neuralgic pains cease, and the appetite improves. Iodide of potassium is of course indicated if there be suspicion of syphilis.

PSEUDO-HYPERTROPHIC MUSCULAR PARALYSIS—DUCHENNE'S PARALYSIS.

Various pathological terms have been applied to this disease. Besides those mentioned above, "myosclerotic paralysis" and "lipomatous muscular atrophy" have been employed by some authors. It is a disease of infancy or childhood, generally commencing before the sixth year. The fibres of the muscles atrophy, but the muscles themselves appear to be hypertrophied in consequence of the development of fat and interstitial connective tissue.

Causes.—Some ascribe the disease to bad food, and to damp, dark dwellings, but there is no evidence that these conditions influence its production. It is less common among the poor than among the rich. It sometimes affects several members of the same family, and in these cases there is probably some hereditary tendency to nervous disorders. It may, however, occur in one child only, and the parents of affected children seldom or never show any sign of the disease. This may be due to the fact that females are rarely affected, and the patients generally die about the time of puberty. Some allude to inherited syphilis as a cause, but there is no reliable evidence on this point. Almost all the cases hitherto reported have been in boys. It manifests itself most frequently in infancy and at about the twelfth month, and the weakness increases with the growth and development.

Morbid anatomy.—There is a gradual growth of interstitial connective, and fibroid tissue among the muscular fibres, and in some parts fat is deposited. The muscles being compressed by these growths undergo degenerative changes, their transverse striæ become indistinct and effaced, and the longitudinal striæ are more or less obliterated. In an advanced stage, the muscles, when cut, appear as a yellow, greasy mass of fat, in which no trace of muscular redness can be perceived. Under the microscope, they consist of cells distended with fatty contents, with a few narrow bands of fibrous tissue and muscular fibres containing nuclei and elongated cells. The growth of nucleated fibrous tissue and of fat cells is the cause of the increase in the size of the muscle. The true muscular fibres suffer secondarily, and under pressure of the abnormal growths they undergo an interstitial change. They are narrowed by pressure, and hence they ultimately diminish in size. The subsequent absorption of the fat further aids in lessening the size of the muscles. Some observers state that there is no change in the spinal cord in this disease; others, however, have found extensive disintegration of the grey matter at the centre of each lateral half of the cord and of the anterior commissure. In this disorder the muscles first affected are those of the back of the thighs and of the calves and of the lower part of the back. In the beginning they are enlarged and firm, and afterwards more or less wasted. Some authorities consider that pseudo-hypertrophic muscular paralysis is the same disease as progressive muscular atrophy.

Symptoms.—The onset is extremely gradual. In some, slight symptoms, as enlargement of muscles or slight weakness, exist for some time before actual disease manifests itself or is even suspected.

There is difficulty in walking and in getting up from the floor, enlargement of the calves, and frequently progressive weakness and wasting of the upper limbs. Sometimes the first thing which attracts attention is a peculiar gait and attitude, owing to weakness of muscles. The child is regarded as remarkably stout, and when he begins to walk the power of maintaining the body in an upright posture is seen to be very small. The child stands with legs wide apart, and shoulders and head thrown back, as if balancing himself. There is weakness in the muscles of the back, and exaggerated curvature of the spine in the lumbar region with the concavity backwards. The shoulders are carried so far back that a vertical line from the scapulæ falls behind the sacrum. When he sits down the curve disappears, or the concavity is in the opposite direction. In walking there is a peculiar oscillation; the child lifts his knees needlessly high; the heels are raised off the ground, and the toes point downwards, and he also sways his body from side to side. The child continues in this state for months, when the muscles of the calves increase rapidly in volume. The muscles, though firm, are weak. The belly is protuberant, and there is a hollow in the lumbar region. The muscles of the back, of the trunk, of the arms, or the upper limbs (excepting the deltoids, which are rather large) are thin, but the child can move them freely in all directions. Those of the face often shrink, while those of the calves and of the buttocks increase in size. With the enlargement there is an increased loss of muscular power, and the child has more and more difficulty in walking; he cannot bring his heels down to the ground; if he attempts to walk he puts his feet very wide apart, the shoulders and arms are thrown as far backwards as possible. The balancing character of his attitude when standing is increased. The child cannot rise from the ground without assistance, owing to weakness of the muscles of the legs. If a little aid is afforded him he raises himself by placing his hands on his knees, and then he grasps his thighs a little higher, till he apparently pushes his trunk up. This peculiar action is pathognomonic of this disease, and is of the utmost diagnostic value. The patellar reflex is absent. This state of paralysis may last for a year or two, when the disease extends to the upper limbs. The child now becomes more and more helpless, loses all power in the lower extremities, and becomes bedridden. He continues in this state for a very long time. The respiration, circulation, and digestion are not impaired, but sooner or later complications occur, and the child becomes prostrate, or death takes place from pneumonia. During the whole period there is no fever. The mind is generally clear, but deficiency of mental power has been noticed in some cases. General and special sensation continues perfect throughout. There is no tenderness of the spine nor any rigidity of limbs. The control over the bladder and rectum is retained. At first the electro-contractility is unimpaired; but when the muscles are greatly wasted it is lowered to faradisation. Later on, as the muscular fibres undergo degeneration, there is loss of electro-contractility. The course of pseudo-hypertrophic paralysis may be thus briefly stated. (1) A period of feeble movements. (2) A period of apparent muscular hypertrophy. (3) A period of extension and aggravation of the paralysis.

Duration.—Death generally takes place between ten and twenty years of age, and is due to complications or to some intercurrent disease. Thus, weakness of the respiratory muscles leads to disease of the lungs, cough and dyspnœa set in, and the patient dies from broncho-pneumonia. Among the intercurrent disorders, measles is apt to end in fatal bronchitis. When scarlet fever occurs it generally proves fatal.

Diagnosis.—The gradual development, the progressive difficulty in movement, a peculiar gait in walking, and the efforts made in rising from the floor, together with the enlargement and firmness of the muscles, constitute a group of symptoms pathognomonic of this affection. In infantile paralysis the onset is sudden, the disease rapidly spreads, but is ultimately localised to a limb or certain muscles. In paraplegia, the weakness of the lower limbs is general, and the sphincters are affected.

Prognosis.—It is highly grave. It depends upon the period at which the disease occurs and the rate of progress. The later it appears and more slowly it advances the better is the prognosis.

Treatment.—We can do little to check the morbid process. The disease is supposed to be due to an error of development in the muscular tissue itself. Those remedies therefore which assist tissue-growth may be recommended. Thus for improvement in the general nutrition, arsenic, phosphorus, strychnine, and other nervine tonics are recommended; cod-liver oil is likely to be useful. Some have erroneously limited the use of fat-forming food with the view of lessening the deposit of fat in the diseased muscles. In this disease, however, there is over-growth of connective tissue which is not affected by fat. Another remedy which undoubtedly influences the muscular nutrition is local faradisation. Several cases have been reported in which faradisation completely checked the progress of the disease, and considerably increased the strength of the lower extremities. Shampooing and passive movements of the limbs may be combined with the electricity.

PARALYSIS AGITANS—SHAKING PALSY.

Paralysis agitans is characterised by trembling of the limbs, occurring independently of muscular exertion, and associated with rigidity of the muscles. There is no absolute powerlessness, but the patient is unable to walk steadily, and generally loses his equilibrium.

Cause.—It is a disorder of advanced life, appears after forty, and becomes more common as life advances. It runs a very protracted course. It is sometimes imputed to violent emotions, such as grief or rage, and to exposure to wet and cold. Injury to peripheral nerves, by inducing neuralgic pains, may lead to trembling of the parts involved. Functional disorders, as hysteria or reflex irritation, may possibly give rise to it. Men are more frequently affected than women.

Morbid appearances.—Nothing definite as regards any lesion in the nervous centres has been yet discovered. Hitherto only various morbid changes have been observed, which are frequently present in the cord and brain under other circumstances. At one time the disease was confounded with multiple sclerosis.

Symptoms.—The disease most frequently sets in gradually, but in rare cases suddenly. When slow and insidious there is at first a sense of profound fatigue or neuralgic pain, in one finger or in one limb. The patient also suffers from subjective sensations of heat and from profuse sweating. There is no rise of temperature. These symptoms are soon followed by tremor or continued shaking of one hand, one thumb, or one foot. The tremor consists of short rhythmical and rapid muscular movements, generally without much force. Violent emotions increase the force and rapidity of the movements. The trembling is beyond the control of the will. It ceases during sleep and under the action of narcotics, and to some extent when the parts are in action as during writing or while lifting a weight. The trembling after a time extends to the other limb of the same side. The patient has a hurried gait in walking, often runs or plunges forwards at any tangible object, but is unable to walk slowly. In advanced cases, trembling very often comes on even when the patient has complete rest of body and mind. The disease sooner or later spreads, and other parts of the body become involved. It sometimes affects the head, the movements of which are nodding or rotatory. Generally, as in hemiplegia, the arm is first affected, the leg of the same side then follows, and later on it affects the arm and leg of the other side. Sometimes both legs are affected at first, and the arms follow; the malady often lingers for months and years, and at last culminates in constant and incessant tremblings of all the limbs, with remissions during the day and total absence of tremor during sleep at night. Rigidity of muscles is associated with the tremors. In most cases, even when the disease becomes fully established, the muscles of the head and neck remain free, although the face presents a sad and tremulous appearance. In paralysis agitans paralysis is secondary to the shaking, and when paralysis occurs it affects the extensor muscles especially. Where the head is seen shaking or nodding without paralysis agitans, the movements are generally due to old age. In some cases, when the patient attempts to rise from his seat he tumbles forward and scarcely moves his legs from the ground. Very often the movements appear to be compulsory, and the patient has a running gait while attempting to walk. This is known as paralysis festinans. In advanced cases the symptoms resemble those of multiple sclerosis. Thus rigidity of the paralysed muscles occurs and is followed by contractions. The rigidity is transient at first, but rapidly becomes permanent, causing considerable deformity of the limbs. The patient often complains of cramps and traction of the affected muscles. The constant traction and fits of trembling prevent sleep and bring on exhaustion. The speech becomes affected, the utterance is slow and difficult, and the tongue is tremulous. The power of swallowing is also impaired. The patient feels great difficulty in carrying food to his mouth, and complains of hyperæsthesia, or a painful sense of heat over the whole body. At last the nutrition becomes defective, the intellect fails, there is unintelligible articulation, great prostration, and bedsores. The patient is bedridden, he becomes exhausted, and dies either convulsed, or from coma, or from delirium, or from lung-complications.

Duration.—The disease lasts for a long time; in some cases for twenty or thirty years.

Diagnosis.—Paralysis agitans is distinguished from disseminated sclerosis by the fact that the tremors in the latter occur only when the muscles are in use, and for the most part involve the head. Paralysis agitans is rarely ever met with under the age of 35; disseminated sclerosis rarely occurs after that age. In the latter complaint the limbs early become paralysed, and the patient has no tendency to run forwards. Trembling may be due to old age (senile), or to abuse of tobacco, opium, ganga, and alcohol. In these cases the etiology is clear, and paralysis is excluded. In mercurial tremors the head and neck are involved, the gums are swollen and painful, salivation is generally present, and there is a history of exposure to the fumes of mercury.

Treatment.—The disease is generally incurable. The state of general health should be improved by iron and various other tonics—

as strychnia, zinc, arsenic, nitrate of silver, phosphorus, and cod-liver oil. If the pains from tremblings and cramps are severe they may be temporarily relieved by sedatives—as bromide of potassium, hyoscyamus, conium, opium, belladonna, or chloral hydrate. Warm baths, cold baths, and shower baths may be of service, and issues in the neck and back have done good in some cases. The continuous electric current has proved serviceable. It should be applied to the spine and to the sympathetic in the neck.

GENERAL PARALYSIS.

It is otherwise known as general paralysis of the insane. General paralysis is due to a diffuse interstitial chronic inflammatory process in the brain. The disease extends to the spinal centres, and atrophy of the brain and the cord is the result. The disease pathologically, or in its anatomical features, resembles cirrhosis of the liver, or lungs, or kidneys. It is a paralysis of both body and mind. The disease progresses slowly. The membranes and the cortical portions of the brain are first affected, and epileptiform convulsions are frequent accompaniments. It is not a mere degenerative disease, for the destruction is due to an active process. The patients are generally of the male sex, and between 30 and 50 years of age. Little is known as to the causation of the disease. Persons previously healthy are most frequently attacked.

Symptoms.—The disease sets in with unaccountable alteration in the manners and character of the patient. He exhibits unusual activity of mind. The appearance, language, and actions show great mental excitement. There is undue irritability or violence of temper. In a few cases there is unusual mental depression; the patient is taciturn and hypochondriacal. This condition of mind soon changes: the patient becomes fanciful and feels much distressed. In some cases the patient has extraordinary delusions as to his wealth and personal importance. A labourer, for instance, thinks that he has thousands a year, or a shoemaker believes himself an earl. A further and very characteristic mental symptom is that, however much the paralysis may have advanced, the patient believes himself to be in perfect health. The mental disturbance is followed by disorders of motion, or progressive paralysis. This begins at one part, and, gradually advancing, sooner or later affects nearly every muscle of the body. Finally, there is complete loss of motion and sensation of the whole body, ending in death. The paralysis at first is slight in degree, and generally begins in the muscles of the tongue and lips, as indicated by tremors and feebleness of the muscles. There is defective and blurred articulation. Next it affects the muscles of the face, causing a sad and blunt expression. There is an altered mode of speech, or stammering, and inability to retain saliva; the tongue is protruded with difficulty, or quivers. The general appearance is that of a drunken man. Then follows weakness in the limbs. The gait becomes unsteady, and the patient staggers; the handwriting becomes irregular and tremulous; there is inability to swallow, and food may pass into the larynx. The pupils are unequal, and both are often contracted more than natural. During the progress of the disease very often apoplectiform or epileptiform convulsions occur. Symptoms of other disorders also supervene—as mania and phthisis. The temperature sometimes becomes very high. When the paralysis is fully established the physical powers are diminished, and the patient cannot walk, or stand, or sit, and is confined to bed. There is involuntary passage of urine and fæces. The paralysis now extends to the head, neck, and trunk, and ends in death, which is most often due to intercurrent pneumonia. The mental derangements continue till the close of the disease. During the whole course digestion and nutrition remain undisturbed. Ophthalmoscopic examination shows hyperæmia, followed by atrophy of the optic disc.

Duration.—A case of general paralysis is seldom protracted beyond two years, and then ends fatally by asthenia or pneumonia.

Diagnosis.—The condition of the mind, the presence of convulsive tremors in the muscles of articulation at the beginning, the general and progressive course of the paralysis, will serve to distinguish this affection from all others.

Treatment.—The treatment is palliative. The patient must not be allowed to brood over his delusions. All external causes of irritation or excitement should be avoided, and the patient must have proper exercise and nourishing diet. Care must be taken to prevent the patient from being choked by his food, which should be always minced up for him. Where syphilis exists, iodide of potassium may be given. Removal to an asylum is generally necessary. Calabar bean is said to lessen excitement.

PROGRESSIVE BULBAR PARALYSIS — LABIO-GLOSSO-LARYNGEAL PARALYSIS.

This disease is characterised by paralysis of the lips, tongue, soft palate, pharynx, and larynx. There is no derangement of the sensory nerves or of the nerves of special senses. There is sometimes wasting of the affected parts, and muscular atrophy elsewhere. The onset of the symptoms is generally insidious, but in rare cases, sudden.

Causes.—These are for the most part obscure. It is a disease of adult life, and attacks men more frequently than women. It has been attributed to exposure to wet and cold and to undue mental and bodily fatigue. In some cases there is a family history of nervous disorders; while in others syphilis and injuries to the head have preceded the advent of the symptoms. The majority of the patients belong to the well-to-do classes.

Anatomical appearances.—Various anatomical changes are found in the floor of the fourth ventricle, especially in the nuclei of the motor nerves on both sides. The nuclei of origin of the hypoglossal nerve, of the spinal accessory, and sometimes of the facial are especially involved, and in some cases the morbid process spreads to the nucleus of the glosso-pharyngeal, the motor portion of the fifth, and to the third and fourth nerves; while the pneumogastric, the auditory, and the sensory portion of the fifth are either unaffected, or attacked only at a very late period. The anterior cornua of the spinal cord frequently participate in the degeneration. In the nuclei of origin of the affected nerves, the motor cells are shrunken and atrophied, and their processes are wanting. Yellow pigmentary atrophy is said to be the most frequent change. Proliferation and sclerotic thickening of the neuroglia are also observed, and these processes sometimes extend to the anterior and lateral columns of the spinal cord. The olivery and restiform bodies and the posterior columns are very rarely involved. The affected muscles are pale, thin, and often in a state of granular degeneration. The motor nerve-fibres are grey and translucent. In cases of the acute form, patches of softening have been found in the medulla, and this process most probably results from occlusion f the vessels.

Symptoms.—There is slight and gradually increasing loss of power of the muscles of the tongue, lips, soft palate, pharynx, and larynx. The tongue feels heavier, and more force is required to move it in speaking and eating. The lips are stiff, and the labial letters cannot be pronounced. The mouth appears elongated, and the lips separated and fixed. The expression of the face is blank and strange. In some cases the paresis of the lips reveals itself as a sensation of slight stiffness, such as might be caused by exposure to severe cold for a short time. Owing to the flaccidity of the lips the saliva dribbles, and as a result of the paralysis of the tongue mastication and deglutition become difficult, the food collects between the gums and the cheeks, and there is difficulty in forming it into a bolus. Particles of food pass into the larynx and are ejected with difficulty. The paralysis of the tongue gradually increases; there is difficulty in protruding it, and it lies motionless on the floor of the mouth. It is often pressed and indented by the teeth. The muscles of the soft palate next suffer; they hang down, so that the posterior nares cannot be closed. When the pharyngeal muscles are attacked there is difficulty of swallowing, and with a fit of coughing, food or drink passes back through the nose. The lips become more and more affected, and the patient cannot blow or spit or whistle; they are flaccid and separated, and the mouth appears elongated and cannot be closed.

As the case advances the larynx becomes implicated, more force is at first required to produce sound, and the effort to make the vocal cords vibrate causes great fatigue. Sometimes explosive sounds are emitted instead of words. Some patients can groan and shout, but cannot articulate syllables. In other cases, the speech is not merely thick as in facial paralysis, nor a meaningless nonsense as in aphasia, but is utterly lost or a slight nasal syllable may be left. The saliva dribbles over the lower lip. At an advanced stage the pneumogastric nerve is involved, and the respiratory muscles and the heart become paralysed. There is great dyspnœa, and the pulse is feeble and extremely irregular and quick. In ordinary cases, notwithstanding the extensive nerve-paralysis, the patient can close the eye, showing that the orbicularis palpebrarum is not affected; and although the larynx is paralysed, the breathing continues, showing that the pneumogastric is not affected. There are separate nerves for vocalisation and for respiration, the spinal accessory being for vocalisation or voluntary opening and closure of the glottis and for tension of the vocal cords, and the pneumogastric for the respiratory movements of the glottis.

These paralyses are unattended with fever, pain, or dizziness, or any mental defect.

Notwithstanding the extensive paralysis of the lips, the sense of taste and the tactile sensibility of the tongue are unimpaired. In advanced cases the paralysed muscles undergo degeneration and become atrophied. The laryngoscope shows paresis of the vocal cords. Under the ophthalmoscope no changes are observed. The appetite is good, but the patient cannot swallow food. The disease seldom runs a rapid course; generally its progress is slow and steady, and death occurs from starvation or from asphyxia from impaction of solid food in the larynx; from an attack of dyspnœa or from syncope, or from complications of the lungs, or from paralysis of the respiratory muscles. The duration varies from six onths to three years.

The disease is sometimes a complication of disseminated scle-
is; similar symptoms occur in the last stage of lateral sclerosis,

and the complaint is often associated with progressive muscular atrophy of the limbs.

Diagnosis and prognosis.—The symptoms, as described above, are characteristic of the disease. The course of the symptoms is always from bad to worse, but temporary arrest and even apparent improvement are sometimes noticed.

Treatment. — The lesions cannot be repaired or the disease arrested. Mental excitement, over-fatigue, various excesses, abuse of alcohol, opium, or other narcotics should be avoided, and the patient's health should be improved as far as possible. To prevent degeneration and atrophy of the paralysed muscles galvanism may be tried. The faradic current may be applied to the affected muscles. It has been recommended that the voltaic current should be applied to the throat, the positive electrode being placed on the back of the neck, and the negative drawn over the side of the pharynx externally, so as to produce reflex movements of deglutition. Galvanic currents may also be sent through the neck, and through the vertebral column, and through the arms, when these are paralysed. Some recommend currents to be sent through the mastoid processes. As internal remedies, nitrate of silver may be tried, and iodide of potassium, if there be any history of syphilis. Belladonna may be given to check the flow of saliva.

Local or Special Paralysis.

Paralysis of parts supplied by the cranial or spinal nerves may be a symptom of brain-disease or of disease of the cord; but in many cases the cause is peripheral, and the nerves themselves are affected. Thus, local paralysis may be due to destruction of a nerve from injury; to the pressure of a tumour, as an aneurism; or mere temporary compression, as from hanging the arm on a chair; to changes in the nerve itself (inflammatory or otherwise); to exposure to cold; to syphilis, gout, or rheumatism; or to the introduction of certain poisons—as lead or mercury—into the system. It is often a sequel of diphtheria. It is also due to diseases of the nuclei of nerves, and of nerves after their emergence from their nuclei. Local paralysis may be limited to a single muscle, or may involve a group or groups of muscles. For example, paralysis may affect only the external rectus of the eye, or the muscles of one side of the face (facial paralysis), or only certain muscles of the tongue or lips. Local paralysis is always complete, and the muscles do not respond to the electrical stimulus, and they soon grow flaccid and waste.

PARALYSIS OF THE OCULO-MOTOR NERVES.

It is a local paralysis, and due to lesions either at their origin or in some part of the course of these nerves. It may be due to (*a*) disease of the brain or cord; (*b*) to intra-orbital affections; (*c*) functional causes, as rheumatism. When due to worms or exposure to cold the paralysis affects the external rectus only; (*d*) syphilitic growths generally affect the base of the brain (where these nerve-trunks are situated). Foreign bodies, as tubercles, cancer, aneurisms, inflammatory exudation-products within the cranium, by causing pressure on the orbital nerves, sometimes lead to paralysis of the muscles of the eye. In disease of the brain or cord there is often paralysis of one or more muscles of the orbit, associated with cerebral symptoms, as headache, delirium, convulsions; also paralysis of other muscles in the form of hemiplegia, paraplegia, &c.

Symptoms.—The paralysis can be best understood by recalling to mind the position of the nerves at their origin and in the various parts of their course. Thus, the third and fourth nerves take their root in the grey substance in the floor of the aqueduct of Sylvius, and the sixth beneath the eminentia teres in the floor of the fourth ventricle. The third, fourth, and the sixth nerves supply the muscles of the eyeball. The fourth is distributed to the superior oblique; the sixth to the external rectus; and the third to the rest of the recti, to the inferior oblique, to the levator palpebræ superioris, and to the circular fibres of the iris and the ciliary muscle. In paralysis of these nerves, one or more of the muscles within the orbit are paralysed. The paralysis is attended with squint, either external or internal, by diplopia (double vision), by want of normal parallelism and proper focus. In paralysis of the third nerve (motor oculi) there is, 1st, dropping of the upper eyelid (ptosis); 2nd, external squint; 3rd, dilated pupil; 4th, accommodation of the eye for distant objects; 5th, the eye cannot be turned upward or downward. When the paralysis affects one only of the three recti there is double vision and strabismus, with defective movement in the direction of the action of the affected muscle. In paralysis of the fourth nerve the superior oblique is affected. Downward movement of the eye is defective, and there is diplopia when both eyes look down. In paralysis of the sixth, the external rectus is affected. There is convergent strabismus with inability to move the eye outwards. There is also double vision on looking at an object on the affected side of the middle line.

Treatment.—In all cases attempts must be made to discover the

cause of the paralysis. If due to syphilis, iodide of potassium and mercury will be of immense service. The former should be first tried in moderate doses, grs. v—x, three times a-day to begin with, and two grains of carbonate of ammonia may be added to each dose. The iodide should be gradually increased until 100 grains or more are taken daily. These large doses sometimes cause vomiting and derangements of the stomach. To prevent these drawbacks it is well to administer them in seltzer-water or other effervescing combinations. In rheumatic paralysis, hot fomentations, counter-irritation to the temple, small doses of iodide of potassium with guaiacum and quinine are likely to be serviceable. In cases of spinal or cerebral disease, the various remedies recommended in preceding chapters may be tried. Diphtheritic cases invariably recover under good food, tonics, &c. In cases of paralysis of the ocular muscles, electricity is often serviceable. It may be applied through the eyelid to the affected muscle, small electrodes being used, and the eye being turned so as to bring the muscle as far as possible within reach. One electrode may also be placed over the muscle, and the other over the temple or on any other part. The galvanic current, slowly interrupted, is the best, and the negative pole should be placed on the muscle. Faradisation is of less service, for only a very weak current can be used with safety, and this does not penetrate to a sufficient depth.

PARALYSIS OF THE FIFTH NERVE.

The sensory portion of the nerve is most often affected, the result being anæsthesia over the regions supplied by the trigeminus. This condition mostly arises from syphilis but may be due to other causes which lead to local paralysis, or to neuralgia of the trigeminus. Where the neuralgia is of great severity and of long duration, it often causes some amount of anæsthesia.

Symptoms.—These are connected with one or all of the three divisions of the nerve. In cases where the whole nerve is involved, either the main trunk or the Gasserian ganglion is degenerated or destroyed, such a result being produced by pressure of a tumour or by inflammatory exudation. In such a case there is complete motor paralysis of the muscles of mastication, and complete sensory paralysis of the parts supplied by the whole nerve. Thus, there is anæsthesia of one half of the head and face as far back as the ear; the other half of the face is sensitive or healthy. The mucous membrane of the eyelids, nose, lips, and also the gums and palate, and a portion of the tongue and the opening of the Eustachian tube, are without sensation. The eye is insensible to external impressions,

and therefore becomes inflamed; the cornea becomes opaque, and in time ulcerates or even sloughs; the nostril on the affected side is dry, and snuff or other acrid powders applied to it fail to produce sneezing; the taste is lost in the anterior two-thirds of the tongue. On the affected side the act of mastication is also imperfect, owing to the loss of sensibility of the mucous membrane of the mouth, and the food collects, unknown to the patient, between the cheeks and gums.

Where a portion of the nerve is involved, the anæsthesia is limited either to its ophthalmic, superior or inferior maxillary division. In affection of the first branch, or the ophthalmic, there is loss of sensation in front of the forehead, upper eyelid, the conjunctiva, and front of the nose. In paralysis of the superior maxillary, anæsthesia will affect the cheek, the upper lip, the side and interior of the nose, and mucous membranes of the cheek, gums, and palate and tonsils. In disease affecting the inferior maxillary branch, the lateral part of the head and face, the ear, lower lip, gums, and tongue will be deprived of sensation, and the muscles of mastication will be paralysed.

Treatment.—When syphilis is suspected to be the cause, iodide of potassium or mercury must be given. If the nerve-affection be due to reflex action, to hysteria, or to inflammation, the cause must be discovered and removed, if possible. For organic disease affecting the brain, medical treatment is of no avail. In some cases electricity is useful in restoring both motion and sensation.

FACIAL PALSY—PARALYSIS OF THE PORTIO DURA—BELL'S PARALYSIS.

This disease, otherwise known as mimetic paralysis of the face, is usually due to an affection of the nerve in some portion of its trunk. The paralysis may be of central origin, as when associated with other cerebral symptoms. In peripheral paralysis the seat of the lesion of the nerve may be within the skull before the nerve passes into the meatus auditorius internus. In such cases paralysis may be due to compression or destruction of the nerve by cerebral tumours, syphilitic or otherwise, by exudations, exostoses, aneurisms, &c., or by thickening of the dura mater. Within the aqueduct of Fallopius paralysis may be caused by effusion, by inflammation of the nerve itself in its passage through the petrous bone, or by its destruction as a result of caries or necrosis. Fractures and gunshot wounds of the petrous bone have led to similar results. External to the temporal bone, after its emergence from the stylomastoid foramen, the paralysis may be due to (1) injury or wounds; (2) disease of the glands and other structures in its neighbourhood causing continuous pressure upon the nerve; (3) contusions and concussions resulting from blows upon the ear; (4) in new-born children, when the forceps have been used during delivery, the nerve is sometimes paralysed as a result of the pressure; (5) rheumatism is one of its causes. Exposure to a draught of cold air, as in a carriage in full motion, or when the face is warm, is a common cause of facial paralysis. It occurs at any age, in both sexes, and on either side of the face. When due to a blow on the ear it is generally on the left side.

Symptoms.—The symptoms of facial palsy vary considerably, according as the loss of power is incomplete or complete, and affects one or several or all the branches of the nerve. The cause of the disorder and the seat of the lesion also influence the symptoms. As a general rule, only one side is affected. Sometimes there are no premonitory symptoms; in other cases, the paralysis is preceded by pain in the ear or side of the face, slight difficulty of hearing, noises in the ears, and disorders of taste. Its invasion is generally gradual, and only in rare cases sudden. When the affection is slight, all that is noticed is an alteration in the expression when certain muscles are used, especially when the patient laughs. When the paralysis is severe, the change in the countenance is very great. Only the muscles on the sound side contract, and they draw the countenance towards that side, because their action is not counter-balanced. The affected side of the face is stiff and devoid of expression. The natural folds are obliterated; the forehead cannot be thrown into furrows, owing to the paralysis of the frontal muscles and the corrugator supercilii, and complete closure of the eyelids is impossible. When attempts are made to cause the orbicularis to contract, the upper lid is lowered, because the levator palpebræ is relaxed, and the ball of the eye is turned upwards. The lower lid does not touch the eyeball; the puncta lachrymalia fail to catch the tears, which trickle over the cheek. As a result of the exposure to air and dust the conjunctiva of the affected side becomes red and inflamed, and the cornea is sometimes affected in a similar manner. The ala of the nose is depressed, and cannot be raised and dilated in forced inspiration. The paralysed half of the mouth shuts less perfectly than the other side; it also opens less completely, and the saliva dribbles from the imperfectly closed lips. The angle of the mouth is lower than on the healthy side. The cheek is flaccid and collapsed, and the mouth and the tip of the nose are drawn to the sound side during laughing and speaking. Owing to paralysis of the buccinator, the cheek puffs out during the face, causing a sad and blunt expression. There is an altered mode of speech, or stammering, and inability to retain saliva; the tongue is protruded with difficulty, or quivers. The general appearance is that of a drunken man. Then follows weakness in the limbs. The gait becomes unsteady, and the patient staggers; the handwriting becomes irregular and tremulous; there is inability to swallow, and food may pass into the larynx. The pupils are unequal, and both are often contracted more than natural. During the progress of the disease very often apoplectiform or epileptiform convulsions occur. Symptoms of other disorders also supervene—as mania and phthisis. The temperature sometimes becomes very high. When the paralysis is fully established the physical powers are diminished, and the patient cannot walk, or stand, or sit, and is confined to bed. There is involuntary passage of urine and fæces. The paralysis now extends to the head, neck, and trunk, and ends in death, which is most often due to intercurrent pneumonia. The mental derangements continue till the close of the disease. During the whole course digestion and nutrition remain undisturbed. Ophthalmoscopic examination shows hyperæmia, followed by atrophy of the optic disc.

Duration.—A case of general paralysis is seldom protracted beyond two years, and then ends fatally by asthenia or pneumonia.

Diagnosis.—The condition of the mind, the presence of convulsive tremors in the muscles of articulation at the beginning, the general and progressive course of the paralysis, will serve to distinguish this affection from all others.

Treatment.—The treatment is palliative. The patient must not be allowed to brood over his delusions. All external causes of irritation or excitement should be avoided, and the patient must have proper exercise and nourishing diet. Care must be taken to prevent the patient from being choked by his food, which should be always minced up for him. Where syphilis exists, iodide of potassium may be given. Removal to an asylum is generally necessary. Calabar bean is said to lessen excitement.

PROGRESSIVE BULBAR PARALYSIS — LABIO-GLOSSO-LARYNGEAL PARALYSIS.

This disease is characterised by paralysis of the lips, tongue, soft palate, pharynx, and larynx. There is no derangement of the sensory nerves or of the nerves of special senses. There is sometimes wasting of the affected parts, and muscular atrophy elsewhere. The onset of the symptoms is generally insidious, but in rare cases, sudden.

Causes.—These are for the most part obscure. It is a disease of adult life, and attacks men more frequently than women. It has been attributed to exposure to wet and cold and to undue mental and bodily fatigue. In some cases there is a family history of nervous disorders; while in others syphilis and injuries to the head have preceded the advent of the symptoms. The majority of the patients belong to the well-to-do classes.

Anatomical appearances.—Various anatomical changes are found in the floor of the fourth ventricle, especially in the nuclei of the motor nerves on both sides. The nuclei of origin of the hypoglossal nerve, of the spinal accessory, and sometimes of the facial are especially involved, and in some cases the morbid process spreads to the nucleus of the glosso-pharyngeal, the motor portion of the fifth, and to the third and fourth nerves; while the pneumogastric, the auditory, and the sensory portion of the fifth are either unaffected, or attacked only at a very late period. The anterior cornua of the spinal cord frequently participate in the degeneration. In the nuclei of origin of the affected nerves, the motor cells are shrunken and atrophied, and their processes are wanting. Yellow pigmentary atrophy is said to be the most frequent change. Proliferation and sclerotic thickening of the neuroglia are also observed, and these processes sometimes extend to the anterior and lateral columns of the spinal cord. The olivery and restiform bodies and the posterior columns are very rarely involved. The affected muscles are pale, thin, and often in a state of granular degeneration. The motor nerve-fibres are grey and translucent. In cases of the acute form, patches of softening have been found in the medulla, and this process most probably results from occlusion f the vessels.

Symptoms.—There is slight and gradually increasing loss of power of the muscles of the tongue, lips, soft palate, pharynx, and larynx. The tongue feels heavier, and more force is required to move it in speaking and eating. The lips are stiff, and the labial letters cannot be pronounced. The mouth appears elongated, and the lips separated and fixed. The expression of the face is blank and strange. In some cases the paresis of the lips reveals itself as a sensation of slight stiffness, such as might be caused by exposure to severe cold for a short time. Owing to the flaccidity of the lips the saliva dribbles, and as a result of the paralysis of the tongue mastication and deglutition become difficult, the food collects between the gums and the cheeks, and there is difficulty in forming it into a bolus. Particles of food pass into the larynx and are ejected with difficulty. The paralysis of the tongue gradually increases; there is difficulty in protruding it, and it lies motionless on the floor of the mouth. It is often pressed and indented by the teeth. The muscles of the soft palate next suffer; they hang down, so that the posterior nares cannot be closed. When the pharyngeal muscles are attacked there is difficulty of swallowing, and with a fit of coughing, food or drink passes back through the nose. The lips become more and more affected, and the patient cannot blow or spit or whistle; they are flaccid and separated, and the mouth appears elongated and cannot be closed.

As the case advances the larynx becomes implicated, more force is at first required to produce sound, and the effort to make the vocal cords vibrate causes great fatigue. Sometimes explosive sounds are emitted instead of words. Some patients can groan and shout, but cannot articulate syllables. In other cases, the speech is not merely thick as in facial paralysis, nor a meaningless nonsense as in aphasia, but is utterly lost or a slight nasal syllable may be left. The saliva dribbles over the lower lip. At an advanced stage the pneumogastric nerve is involved, and the respiratory muscles and the heart become paralysed. There is great dyspnœa, and the pulse is feeble and extremely irregular and quick. In ordinary cases, notwithstanding the extensive nerve-paralysis, the patient can close the eye, showing that the orbicularis palpebrarum is not affected; and although the larynx is paralysed, the breathing continues, showing that the pneumogastric is not affected. There are separate nerves for vocalisation and for respiration, the spinal accessory being for vocalisation or voluntary opening and closure of the glottis and for tension of the vocal cords, and the pneumogastric for the respiratory movements of the glottis.

These paralyses are unattended with fever, pain, or dizziness, or any mental defect.

Notwithstanding the extensive paralysis of the lips, the sense of taste and the tactile sensibility of the tongue are unimpaired. In advanced cases the paralysed muscles undergo degeneration and become atrophied. The laryngoscope shows paresis of the vocal cords. Under the ophthalmoscope no changes are observed. The appetite is good, but the patient cannot swallow food. The disease seldom runs a rapid course; generally its progress is slow and steady, and death occurs from starvation or from asphyxia from impaction of solid food in the larynx; from an attack of dyspnœa or from syncope, or from complications of the lungs, or from paralysis of the respiratory muscles. The duration varies from six months to three years.

The disease is sometimes a complication of disseminated sclerosis; similar symptoms occur in the last stage of lateral sclerosis, as strychnia, zinc, arsenic, nitrate of silver, phosphorus, and cod-liver oil. If the pains from tremblings and cramps are severe they may be temporarily relieved by sedatives—as bromide of potassium, hyoscyamus, conium, opium, belladonna, or chloral hydrate. Warm baths, cold baths, and shower baths may be of service, and issues in the neck and back have done good in some cases. The continuous electric current has proved serviceable. It should be applied to the spine and to the sympathetic in the neck.

GENERAL PARALYSIS.

It is otherwise known as general paralysis of the insane. General paralysis is due to a diffuse interstitial chronic inflammatory process in the brain. The disease extends to the spinal centres, and atrophy of the brain and the cord is the result. The disease pathologically, or in its anatomical features, resembles cirrhosis of the liver, or lungs, or kidneys. It is a paralysis of both body and mind. The disease progresses slowly. The membranes and the cortical portions of the brain are first affected, and epileptiform convulsions are frequent accompaniments. It is not a mere degenerative disease, for the destruction is due to an active process. The patients are generally of the male sex, and between 30 and 50 years of age. Little is known as to the causation of the disease. Persons previously healthy are most frequently attacked.

Symptoms.—The disease sets in with unaccountable alteration in the manners and character of the patient. He exhibits unusual activity of mind. The appearance, language, and actions show great mental excitement. There is undue irritability or violence of temper. In a few cases there is unusual mental depression; the patient is taciturn and hypochondriacal. This condition of mind soon changes: the patient becomes fanciful and feels much distressed. In some cases the patient has extraordinary delusions as to his wealth and personal importance. A labourer, for instance, thinks that he has thousands a year, or a shoemaker believes himself an earl. A further and very characteristic mental symptom is that, however much the paralysis may have advanced, the patient believes himself to be in perfect health. The mental disturbance is followed by disorders of motion, or progressive paralysis. This begins at one part, and, gradually advancing, sooner or later affects nearly every muscle of the body. Finally, there is complete loss of motion and sensation of the whole body, ending in death. The paralysis at first is slight in degree, and generally begins in the muscles of the tongue and lips, as indicated by tremors and feebleness of the muscles. There is defective and blurred articulation. Next it affects the muscles of

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Symptoms.—The paralysis can be best understood by recalling to mind the position of the nerves at their origin and in the various parts of their course. Thus, the third and fourth nerves take their root in the grey substance in the floor of the aqueduct of Sylvius, and the sixth beneath the eminentia teres in the floor of the fourth ventricle. The third, fourth, and the sixth nerves supply the muscles of the eyeball. The fourth is distributed to the superior oblique; the sixth to the external rectus; and the third to the rest of the recti, to the inferior oblique, to the levator palpebræ superioris, and to the circular fibres of the iris and the ciliary muscle. In paralysis of these nerves, one or more of the muscles within the orbit are paralysed. The paralysis is attended with squint, either external or internal, by diplopia (double vision), by want of normal parallelism and proper focus. In paralysis of the third nerve (motor oculi) there is, 1st, dropping of the upper eyelid (ptosis); 2nd, external squint; 3rd, dilated pupil; 4th, accommodation of the eye for distant objects; 5th, the eye cannot be turned upward or downward. When the paralysis affects one only of the three recti there is double vision and strabismus, with defective movement in the direction of the action of the affected muscle. In paralysis of the fourth nerve the superior oblique is affected. Downward movement of the eye is defective, and there is diplopia when both eyes look down. In paralysis of the sixth, the external rectus is affected. There is convergent strabismus with inability to move the eye outwards. There is also double vision on looking at an object on the affected side of the middle line.

Treatment.—In all cases attempts must be made to discover the

cause of the paralysis. If due to syphilis, iodide of potassium and mercury will be of immense service. The former should be first tried in moderate doses, grs. v—x, three times a-day to begin with, and two grains of carbonate of ammonia may be added to each dose. The iodide should be gradually increased until 100 grains or more are taken daily. These large doses sometimes cause vomiting and derangements of the stomach. To prevent these drawbacks it is well to administer them in seltzer-water or other effervescing combinations. In rheumatic paralysis, hot fomentations, counter-irritation to the temple, small doses of iodide of potassium with guaiacum and quinine are likely to be serviceable. In cases of spinal or cerebral disease, the various remedies recommended in preceding chapters may be tried. Diphtheritic cases invariably recover under good food, tonics, &c. In cases of paralysis of the ocular muscles, electricity is often serviceable. It may be applied through the eyelid to the affected muscle, small electrodes being used, and the eye being turned so as to bring the muscle as far as possible within reach. One electrode may also be placed over the muscle, and the other over the temple or on any other part. The galvanic current, slowly interrupted, is the best, and the negative pole should be placed on the muscle. Faradisation is of less service, for only a very weak current can be used with safety, and this does not penetrate to a sufficient depth.

PARALYSIS OF THE FIFTH NERVE.

The sensory portion of the nerve is most often affected, the result being anæsthesia over the regions supplied by the trigeminus. This condition mostly arises from syphilis but may be due to other causes which lead to local paralysis, or to neuralgia of the trigeminus. Where the neuralgia is of great severity and of long duration, it often causes some amount of anæsthesia.

Symptoms.—These are connected with one or all of the three divisions of the nerve. In cases where the whole nerve is involved, either the main trunk or the Gasserian ganglion is degenerated or destroyed, such a result being produced by pressure of a tumour or by inflammatory exudation. In such a case there is complete motor paralysis of the muscles of mastication, and complete sensory paralysis of the parts supplied by the whole nerve. Thus, there is anæsthesia of one half of the head and face as far back as the ear; the other half of the face is sensitive or healthy. The mucous membrane of the eyelids, nose, lips, and also the gums and palate, and a portion of the tongue and the opening of the Eustachian tube, are without sensation. The eye is insensible to external impressions,

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PARALYSIS OF THE OCULO-MOTOR NERVES.

It is a local paralysis, and due to lesions either at their origin or in some part of the course of these nerves. It may be due to (*a*) disease of the brain or cord; (*b*) to intra-orbital affections; (*c*) functional causes, as rheumatism. When due to worms or exposure to cold the paralysis affects the external rectus only; (*d*) syphilitic growths generally affect the base of the brain (where these nerve-trunks are situated). Foreign bodies, as tubercles, cancer, aneurisms, inflammatory exudation-products within the cranium, by causing pressure on the orbital nerves, sometimes lead to paralysis of the muscles of the eye. In disease of the brain or cord there is often paralysis of one or more muscles of the orbit, associated with cerebral symptoms, as headache, delirium, convulsions; also paralysis of other muscles in the form of hemiplegia, paraplegia, &c.

Symptoms.—The paralysis can be best understood by recalling to mind the position of the nerves at their origin and in the various parts of their course. Thus, the third and fourth nerves take their root in the grey substance in the floor of the aqueduct of Sylvius, and the sixth beneath the eminentia teres in the floor of the fourth ventricle. The third, fourth, and the sixth nerves supply the muscles of the eyeball. The fourth is distributed to the superior oblique; the sixth to the external rectus; and the third to the rest of the recti, to the inferior oblique, to the levator palpebræ superioris, and to the circular fibres of the iris and the ciliary muscle. In paralysis of these nerves, one or more of the muscles within the orbit are paralysed. The paralysis is attended with squint, either external or internal, by diplopia (double vision), by want of normal parallelism and proper focus. In paralysis of the third nerve (motor oculi) there is, 1st, dropping of the upper eyelid (ptosis); 2nd, external squint; 3rd, dilated pupil; 4th, accommodation of the eye for distant objects; 5th, the eye cannot be turned upward or downward. When the paralysis affects one only of the three recti there is double vision and strabismus, with defective movement in the direction of the action of the affected muscle. In paralysis of the fourth nerve the superior oblique is affected. Downward movement of the eye is defective, and there is diplopia when both eyes look down. In paralysis of the sixth, the external rectus is affected. There is convergent strabismus with inability to move the eye outwards. There is also double vision on looking at an object on the affected side of the middle line.

Treatment.—In all cases attempts must be made to discover the

cause of the paralysis. If due to syphilis, iodide of potassium and mercury will be of immense service. The former should be first tried in moderate doses, grs. v—x, three times a-day to begin with, and two grains of carbonate of ammonia may be added to each dose. The iodide should be gradually increased until 100 grains or more are taken daily. These large doses sometimes cause vomiting and derangements of the stomach. To prevent these drawbacks it is well to administer them in seltzer-water or other effervescing combinations. In rheumatic paralysis, hot fomentations, counter-irritation to the temple, small doses of iodide of potassium with guaiacum and quinine are likely to be serviceable. In cases of spinal or cerebral disease, the various remedies recommended in preceding chapters may be tried. Diphtheritic cases invariably recover under good food, tonics, &c. In cases of paralysis of the ocular muscles, electricity is often serviceable. It may be applied through the eyelid to the affected muscle, small electrodes being used, and the eye being turned so as to bring the muscle as far as possible within reach. One electrode may also be placed over the muscle, and the other over the temple or on any other part. The galvanic current, slowly interrupted, is the best, and the negative pole should be placed on the muscle. Faradisation is of less service, for only a very weak current can be used with safety, and this does not penetrate to a sufficient depth.

Paralysis of the Fifth Nerve.

The sensory portion of the nerve is most often affected, the result being anæsthesia over the regions supplied by the trigeminus. This condition mostly arises from syphilis but may be due to other causes which lead to local paralysis, or to neuralgia of the trigeminus. Where the neuralgia is of great severity and of long duration, it often causes some amount of anæsthesia.

Symptoms.—These are connected with one or all of the three divisions of the nerve. In cases where the whole nerve is involved, either the main trunk or the Gasserian ganglion is degenerated or destroyed, such a result being produced by pressure of a tumour or by inflammatory exudation. In such a case there is complete motor paralysis of the muscles of mastication, and complete sensory paralysis of the parts supplied by the whole nerve. Thus, there is anæsthesia of one half of the head and face as far back as the ear; the other half of the face is sensitive or healthy. The mucous membrane of the eyelids, nose, lips, and also the gums and palate, and a portion of the tongue and the opening of the Eustachian tube, are without sensation. The eye is insensible to external impressions,

and therefore becomes inflamed; the cornea becomes opaque, and in time ulcerates or even sloughs; the nostril on the affected side is dry, and snuff or other acrid powders applied to it fail to produce sneezing; the taste is lost in the anterior two-thirds of the tongue. On the affected side the act of mastication is also imperfect, owing to the loss of sensibility of the mucous membrane of the mouth, and the food collects, unknown to the patient, between the cheeks and gums.

Where a portion of the nerve is involved, the anæsthesia is limited either to its ophthalmic, superior or inferior maxillary division. In affection of the first branch, or the ophthalmic, there is loss of sensation in front of the forehead, upper eyelid, the conjunctiva, and front of the nose. In paralysis of the superior maxillary, anæsthesia will affect the cheek, the upper lip, the side and interior of the nose, and mucous membranes of the cheek, gums, and palate and tonsils. In disease affecting the inferior maxillary branch, the lateral part of the head and face, the ear, lower lip, gums, and tongue will be deprived of sensation, and the muscles of mastication will be paralysed.

Treatment.—When syphilis is suspected to be the cause, iodide of potassium or mercury must be given. If the nerve-affection be due to reflex action, to hysteria, or to inflammation, the cause must be discovered and removed, if possible. For organic disease affecting the brain, medical treatment is of no avail. In some cases electricity is useful in restoring both motion and sensation.

FACIAL PALSY—PARALYSIS OF THE PORTIO DURA—BELL'S PARALYSIS.

This disease, otherwise known as mimetic paralysis of the face, is usually due to an affection of the nerve in some portion of its trunk. The paralysis may be of central origin, as when associated with other cerebral symptoms. In peripheral paralysis the seat of the lesion of the nerve may be within the skull before the nerve passes into the meatus auditorius internus. In such cases paralysis may be due to compression or destruction of the nerve by cerebral tumours, syphilitic or otherwise, by exudations, exostoses, aneurisms, &c., or by thickening of the dura mater. Within the aqueduct of Fallopius paralysis may be caused by effusion, by inflammation of the nerve itself in its passage through the petrous bone, or by its destruction as a result of caries or necrosis. Fractures and gunshot wounds of the petrous bone have led to similar results. External to the temporal bone, after its emergence from the stylomastoid foramen, the paralysis may be due to (1) injury or wounds; (2) disease of the glands and other structures in its neighbourhood causing continuous pressure upon the nerve; (3) contusions and concussions resulting from blows upon the ear; (4) in new-born children, when the forceps have been used during delivery, the nerve is sometimes paralysed as a result of the pressure; (5) rheumatism is one of its causes. Exposure to a draught of cold air, as in a carriage in full motion, or when the face is warm, is a common cause of facial paralysis. It occurs at any age, in both sexes, and on either side of the face. When due to a blow on the ear it is generally on the left side.

Symptoms.—The symptoms of facial palsy vary considerably, according as the loss of power is incomplete or complete, and affects one or several or all the branches of the nerve. The cause of the disorder and the seat of the lesion also influence the symptoms. As a general rule, only one side is affected. Sometimes there are no premonitory symptoms; in other cases, the paralysis is preceded by pain in the ear or side of the face, slight difficulty of hearing, noises in the ears, and disorders of taste. Its invasion is generally gradual, and only in rare cases sudden. When the affection is slight, all that is noticed is an alteration in the expression when certain muscles are used, especially when the patient laughs. When the paralysis is severe, the change in the countenance is very great. Only the muscles on the sound side contract, and they draw the countenance towards that side, because their action is not counter-balanced. The affected side of the face is stiff and devoid of expression. The natural folds are obliterated; the forehead cannot be thrown into furrows, owing to the paralysis of the frontal muscles and the corrugator supercilii, and complete closure of the eyelids is impossible. When attempts are made to cause the orbicularis to contract, the upper lid is lowered, because the levator palpebræ is relaxed, and the ball of the eye is turned upwards. The lower lid does not touch the eyeball; the puncta lachrymalia fail to catch the tears, which trickle over the cheek. As a result of the exposure to air and dust the conjunctiva of the affected side becomes red and inflamed, and the cornea is sometimes affected in a similar manner. The ala of the nose is depressed, and cannot be raised and dilated in forced inspiration. The paralysed half of the mouth shuts less perfectly than the other side; it also opens less completely, and the saliva dribbles from the imperfectly closed lips. The angle of the mouth is lower than on the healthy side. The cheek is flaccid and collapsed, and the mouth and the tip of the nose are drawn to the sound side during laughing and speaking. Owing to paralysis of the buccinator, the cheek puffs out during expiration. The patient cannot blow or whistle, or utter labial letters, or expectorate. Owing to paralysis of the levator labii superioris and of the levator anguli oris, the patient cannot elevate the upper lip, or expose the teeth on the affected side. Paralysis of the zygomaticus and of the levator labii superioris alæque nasi causes the ala nasi to fall in, and the nasal aperture becomes diminished. The tongue is not affected in its movements and articulation is unimpaired. Mastication is undisturbed, but the patient has difficulty in retaining fluids, and when eating, the food is apt to collect between the cheeks and the teeth, and has to be removed by the fingers. On opening the mouth the tongue, when protruded, deviates towards the sound side, the tip of the uvula is also displaced towards the sound side. The taste is more or less impaired. The symptoms of Bell's paralysis vary according as the source of the disease is central or peripheral, and if peripheral according as the lesion is within the skull, in the petrous bone, or in the nerve outside the skull.

In complete cases of facial paralysis, there is want of reflex movements in the muscles of the face, and the electric contractility is quite extinct. In recent and uncomplicated cases there is only loss of motion, the sensation is perfect. In long-standing cases, owing to some nutritive derangements in the parts supplied by the affected nerve filaments, other symptoms are superadded such as emaciation and flabby condition of the facial muscles, disappearance of fat, and a shrivelled condition of the skin.

When due to cerebral mischief, or to some disease of the base of the skull, the paralysis is associated with palsy of other cerebral nerves and other brain-symptoms as headache, convulsions, &c. In this central palsy the paralysis is limited to the inferior facial muscles, and the eyelids and upper half of the face are seldom affected. The orbicularis palpebrarum is not paralysed. The reflex excitability and the electric irritability are retained or increased. The muscles do not waste. Deviation of the tongue is more common in the cerebral form. Where the morbid process is peripheral the superior as well as the inferior facial branches are affected. The paralysis is complete. The reflex or electric excitability is impaired or lost. Obliquity of the uvula is often observed in health, sometimes on the right and sometimes on the opposite side. There will be dryness of the tongue owing to the interference with the salivary secretion. Other symptoms are perversion of sense of taste in the corresponding side of the tongue, and slight drawing of the tongue towards the opposite side. In lesion within the aqueduct of Fallopius there will be otorrhœa, history of caries of the temporal bone, hardness of hearing, or deafness owing to paralysis of the tensor tympani, or to hyperæsthesia of the auditory nerve. If the lesion be behind the geniculate ganglia, the uvula will be drawn to the sound side and the palate will become straight instead of arched, and there will be paralysis of the soft palate. If the nerve outside the skull (peripheral ramifications) be affected, the eyes are wide open, the lower half of the face is paralysed. The ear is sound, the taste normal, the uvula straight. There may be a history of a blow on the ear, or of exposure to cold, or some swelling behind the ear. When due to cold or debility, or to syphilis, recovery takes place in from six to ten weeks. If due to cerebral or intracranial mischief, or caries of the petrous bone, the prospects of cure are remote. Even in favorable cases, if the paralysis becomes chronic, the recovery is very slow if the response to electricity is feeble or absent.

Facial paralysis is sometimes, though very rarely, bilateral. The muscles on both sides of the face are then paralysed, and the countenance loses all expression. In this affection all the branches of the facial nerve are affected. In complete cases we find lagophthalmus and lachrymation of both eyes, which soon become inflamed. There is difficulty of opening the mouth, of moving the lips, difficult or imperfect mastication, and defective speech. Saliva dribbles from the mouth and there is nasal twang. The affection is generally due to syphilis; the seat of lesion being at the base of the brain, in the medulla oblongata, or the pons Varolii. If the lesion is central, the conducting power of the nerve-trunks is retained for an indefinite period, but if the lesion is in the course of the nerves, their conducting power is soon lost. If the paralysed muscles are the seat of reflex movements, the paralysis is due to some affection of the nerve-centres. Facial diplegia is a characteristic feature of progressive bulbar paralysis.

Treatment.—If the paralysis be due to injury, local antiphlogistic remedies, as leeches and cold compresses, should be applied. The paralysis in new-born children subsides without treatment. In cases due to cold, warm poultices or wadding should be applied to the side of the face or ear, diaphoretics, as aconite, may be given, and purgatives if required. A blister behind the ear is often of service. In other cases the cause must be discovered, and dealt with, if possible. Large doses of iodide of potassium are indicated if there be a history of syphilis. Strychnia may be tried if the condition becomes chronic. Electricity often proves a very efficacious remedy. In slight cases a weak faradic current may be tried to the affected muscles. In severe cases the constant current is more likely to prove efficacious. One pole should be placed on the mastoid process, while the other is applied to the various muscles. Stimulating liniments, such as the compound liniment of mustard, may be used at the same time.

PARALYSIS—HEMIPLEGIA—PARAPLEGIA.

Having now given a detailed description of the various diseases of the nervous system which are accompanied by paralysis, it seems advisable to terminate this portion of the work with a succinct account of paralysis in general. Paralysis signifies a condition in which the power of voluntarily exciting the contraction of one or more muscles is lost. The word *paresis* is now used to denote a slighter form of paralysis. The cause of all muscular power being in the nervous system, diminished or total loss of motor power is one of the most common consequences of cerebral or spinal diseases. When sensation is similarly affected, that is to say, when sensory impressions are no longer transmitted from their seats of origin to those portions of the brain which are involved in taking cognisance of them, the condition known as sensory paralysis or anæsthesia is developed. Motor and sensory paralysis may co-exist.

Motor paralysis is due to defects or lesions in various parts of the nervous and muscular systems. As a result of definite lesions in the cerebral cortex, it may be impossible, by any effort of the will, to make certain muscles contract. In a second class of cases, the voluntary motor incitations are impeded in transmission in their course through some part of the nerve-centres, but below the cortex in which they originate. Thus the interruption may be in some portion of their cerebral path, as in the corpus striatum; in some portion of their spinal path; or, lastly, in their passage through the peripheral nerves. In another form of paralysis, the nerve-centres and the nerves are perfectly normal, but the muscles themselves are the seat of degenerative changes which interfere with or prevent their contraction. In this last class of cases, however, it is highly probable that the condition of the muscles is secondary to lesions of the spinal cord or brain.

In all cases of apparent paralysis, it is necessary to determine the true nature of the case, and to ascertain that the disorder of motion is not due to some affection of the joints or muscles. Having decided that the case is really one of paralysis, the next point to be ascertained is the seat of the lesion, *i.e.* whether this is to be found in the brain, in the spinal cord, or in the nerves. There are three principal classes of paralysis: 1. Those of encephalic origin. 2. Those of spinal origin, and 3. Those due to affections of the peripheral nerves.

1. *Paralysis of encephalic origin.*—The parts affected are usually one half of the face and the arm and leg of the same side: the muscles of the trunk are rarely implicated. The attack is usually preceded by a fit of apoplexy or epilepsy. The arm is more affected than the leg; the functions of the bladder and rectum are not interfered with. Cutaneous sensibility is intact or is slightly impaired. The electrical irritability of the paralysed muscles is not diminished, but at first somewhat increased. The paralysis occurs as frequently on one as on the other side of the body; and sometimes, though very rarely, both sides are affected at the same time. When the lesion is situated on the right side of the brain we have left hemiplegia, and when on the left the paralysis is on the right side of the body.

The symptoms vary according to the size and position of the lesion, which is generally in or near the corpus striatum. When the lesion, *i. e.* the hæmorrhage or softening, is considerable, apoplexy, either sudden or gradually supervening, is the first symptom, and the unconsciousness remains for a variable period. When the lesion is comparatively small, symptoms of apoplexy will probably be wanting, and there will instead be slight confusion or vertigo, and a sense of numbness or formication in the parts in which paralysis will shortly become developed.

The symptoms which manifest themselves after consciousness has been restored, supposing that it has been temporarily lost, are as follows:—Partial and incomplete paralysis of the facial muscles on the affected side, the angle of the mouth is drawn down. No decided mental disorder, but some confusion of ideas and loss of memory of events connected with the seizure; some difficulty of speech; deviation of the tip of the tongue, when protruded, towards the paralysed side; more or less complete loss of power of movement in the arm and leg, and a flaccid state of the muscles of these parts; slight anæsthesia or numbness, and elevation of temperature of the paralysed parts.

As time goes on, the symptoms more or less gradually subside, the motor power in the limbs being the last to be restored, and the leg recovering sooner than the arm. In severe cases, recovery is only imperfect. Sometimes rigidity sets in in the paralysed muscles, and this condition may appear at an early or at a late stage. In cases where there is no degeneration of the muscles, they respond more freely than ordinarily to the electric current; the electro-muscular contractility is in excess. Such cases are generally due to an irritative lesion in the brain, and rigidity is an early symptom. In another class of cases, the excitability is diminished and the muscles are flaccid. In a third class there is no difference, as regards electrical reactions, on the two sides.

In comparing together a large number of cases of hemiplegia, it will be found that a marked difference exists in the nature, gravity, and duration of the symptoms. There may be slight paralysis of one side of the face, slight weakness of the arm, but no affection of the leg. In other cases, all three parts are completely paralysed, and between these extremes there are many varieties. Likewise with regard to the psychical symptoms, they may be almost wanting or very profound.

2. *Paralyses of spinal origin* take for the most part the form of paraplegia, that is, loss of motion, with more or less impairment of sensation of the lower extremities and lower part of the trunk, attended with disturbance of the functions of the bladder and rectum. The symptoms generally come on in a gradual manner; but sometimes, as in cases of hæmorrhage of the cord, their advent is sudden. As a general rule, they are not accompanied by convulsions or loss of consciousness. Both sides of the body are generally involved, though not always to the same extent. The paralysis seldom invades the arms, at all events till a late period. Sensation is variously affected in the paralysed parts; it is rarely normal; sometimes there is hyperæsthesia and sometimes anæsthesia. A feeling of constriction round the trunk is a marked symptom in some cases, and is felt at or near the upper limit of the defective sensibility. The electrical irritability is generally diminished, and the paralysed muscles soon show signs of wasting. When the lesion or injury is confined to one half of the cord, and in the lumbar or dorsal region only, the leg on that side will be paralysed. If the lesion be higher up, in the cervical region, the arm will also be affected, but there will be no paralysis of the face.

3. *Peripheral paralysis.*—In this form, the paralysed muscles are cut off from communication with their nerve-centres, or communicate directly with centres whose physiological activity has been destroyed by disease. In "central paralysis" the portion of the nerve-centre is sound from which the nerves supplying the paralysed muscles take origin. In peripheral paralysis the reflex stimulation of the paralysed muscles is impossible; they also waste very rapidly. The irritability of the muscle to the faradic current is rapidly diminished and in most cases is ultimately destroyed. Their sensitiveness to the continuous current is increased. The loss of power, in the majority of cases, is limited to the muscles supplied by particular nerves. The atrophy supervenes within a

few weeks from the onset of the paralysis and speedily becomes marked, the change being most prominent in the muscles of the limbs and those of the trunk. The conditions are due to lesions of some part of the trunk of a nerve, or to degenerative or other changes in the ganglion-cells in the nerve-centres. In cases of paraplegia due to transverse lesions in the cervical or upper dorsal region, the muscles of both upper and lower extremities will be paralysed, but the signs of peripheral paralysis (the reaction of degeneration) will be found in the upper extremities and not in the lower.

Paralysis of sensation shows itself in the form of anæsthesia of varying degrees and extent. This may be either of peripheral origin, or due to diseases of the nervous centres. Cutaneous anæsthesia is sometimes an important symptom of approaching cerebral hæmorrhage, numbness is felt in one half of the face, or in the limbs on one side, and is followed by coma and hemiplegia. After the attack, cutaneous anæsthesia is a common symptom, but it soon passes off. Its extent is not identical with that of the motor paralysis. If the hæmorrhage implicates the medulla oblongata and pons Varolii, the anæsthesia may be on the opposite side. As a general rule, the symptom, unless when due to cerebral tumours, gradually passes off.

In lesions of the spinal cord, anæsthesia of the lower extremities is often extensive and complete; but in some cases it is altogether absent, and in others only slight. It is generally bilateral, but when the lesion is limited to one half of the cord, the loss of sensation will be felt in the opposite limb. The condition is subject to manifold variations, depending upon the changes in the lesions. Cutaneous anæsthesia, of spinal origin, predisposes to bedsores, which should be guarded against, as far as possible, in all cases in which this symptom is present.

PROGRESSIVE FACIAL ATROPHY.

The disease is rare. When confined to one side of the face, it is known as hemi-atrophia facialis. Two cases are recorded in the 'Report of the St. Bartholomew's Hospital College' for the year 1882. The affection is more common in women than in men, and it is met with in girls as well as in women. In a majority of cases it is seated on the left side. The disease gives rise to atrophy of the facial muscles, and also of others in the neighbourhood, and sometimes involves even the bones.

Causes.—The disease may be due to injury or fall on the left side of the face, or neck, or shoulder. Infantile paralysis; scarlatina, measles, and erysipelas may lead to it. Epilepsy, chorea, and syphilis are known to cause progressive facial paralysis.

Symptoms.—The atrophy is often accompanied or preceded by neuralgic pains along the peripheral nerves of the trigeminus. Toothache is a prominent and precursory symptom. Degeneration or marked sinking in of the eye is invariably noticed. In many cases a patch of yellowish skin is noticed on the left cheek, the patch disappearing with the atrophy. The atrophy spreads rapidly and affects the skin, subcutaneous tissue, muscles, bones, and cartilages of the face. There are also changes in the left eye. In the integument there is rapid atrophy with discoloration, and the hairs on different parts of the face turn white or grey, or fall out. There is gradual disappearance of the subcutaneous fat. The cutaneous sensibility either remains normal or is increased. The muscles undergo rapid atrophy, but their irritability and contractility are well retained. The occipito-frontalis and the corrugator supercilii are quite atrophied. The bones have joined in the general wasting. The cyrtometric tracing shows a marked diminution in the left half-circumference of the head. The left side of the face looks much distorted. The skin over it has a withered appearance, and is not so freely moveable over the bones as on the healthy right half of the face. There is a great depression over the upper eyebrow. The atrophy also extends to the nose, ear, tongue, palate, and uvula. The tip of the nose is deviated to the left side. There is a big depression in the temporal fossa. The sense of smell, of hearing, and of taste is not altered. Some of the muscles of the neck and of the chest on the left side are also in a state of atrophy. The left breast appears wasted. The left shoulder is sometimes very much attenuated.

In this affection there is no paralysis. The disease is unaccompanied by any cerebral mischief. Beyond atrophy the patient enjoys good health. The progress is extremely slow.

Pathology.—Many of these symptoms are accounted for by the supposition of a sympathetic irritation. The spread of atrophy is limited to the distribution of the trigeminus and its branches, and of the cervical sympathetic ganglia. Sclerotic changes take place in these ganglia, giving rise to irritation of the nerves in connection with them. Sclerosis and enlargement of the Gasserian ganglion give rise to violent neuralgia and various trophic changes in the eye, which show that these are true trophic fibres. Atrophy of the skin and muscles is due to the formation of fibrous tissue in the subcutaneous tissue, and causing contraction of the blood-vessels. Long-continued application of the continuous current to the cervical sympathetic ganglia gives relief in this affection, and this fact shows that the primary lesion is in the ganglia in question.

ESSENTIAL CONTRACTION WITH RIGIDITY OF THE EXTREMITIES.

Essential contraction with rigidity of the limbs is a local spasmodic disease. As a primary affection, it occurs during infancy and childhood, and is said to be a form of exito-motor disturbance. It is sometimes associated with, or follows, laryngismus stridulus or convulsions. It is an involuntary tonic contraction of the limbs, independent of any appreciable organic lesion of the cerebro-spinal axis.

Causes.—It is common in children between one and three years; and is often due to reflex causes, as dentition, improper food, and irritation of the genitals. It may also depend upon general debility and anæmia. The disease often occurs during the course of a convalescence from acute or chronic disorders, which markedly interfere with nutrition and assimilation. Thus, after typhus and intermittent fevers, after Bright's disease and diphtheria, muscular cramps sometimes result.

The cramps are idiopathic; they result from derangement of the tissues, and give rise to various functional disturbance. The spasms which arise during pregnancy, and after delivery, are of this nature.

Symptoms.—When the affection occurs in a child, for several days before the symptoms set in the patient is restless, and complains of illness and lassitude. After a time there is shooting pain along the course of the nerves of the limbs. There is also some sense of formication and stiffness of the affected muscles. This is followed by cramps in the calves of the legs, passing into tonic contractions. It sometimes happens that the child, after a restless and uneasy night, presents in the morning tonic contractions of both feet, the insteps are swollen and look smooth and polished. In anæmic cases the disease sets in with various nervous disorders, as headache and giddiness, which are soon followed by tonic contractions of the limb. When the disease is established, the thumbs are flexed into the palms, and the flexed fingers conceal the thumbs. The contractions often affect the wrist-joints. The knees are rarely affected. The lower limbs are usually brought into permanent extension. The disease always intermits. The child complains of pain and stiffness in the affected parts, the muscles are hard and rigid, and extremely painful. The pain is severe on extending the upper extremities, and on flexing the lower. There is no fever. The disease runs a very short course. The contractions cease after a few days, and the muscles move without pain. In a few cases relapses occur. The intelligence is perfect. There is restlessness and irritability. In fatal cases convulsions precede death. The disease may go on for months, slowly increasing in severity. In most cases the disease slowly subsides, and at last recovery takes place.

Diagnosis.—It is often mistaken for contractions due to cerebral or spinal disease. In cerebral disease various disorders of intelligence and sensibility, fever, constipation, and vomiting precede or accompany the contraction. In essential contraction these symptoms do not occur. In cerebral disease the pulse is irregular, a single limb is generally affected, and the effect is always permanent. Essential contraction is remarkably intermittent, and begins in the fingers or toes.

Prognosis.—Is favorable when due to reflex causes; the occurrence of convulsions renders the prognosis serious. If accompanied with laryngismus stridulus it is favorable, if due to some permanent disease it is unfavorable.

Treatment.—The cause should be removed, whenever possible, and violent remedies, as leeching, calomel, drastic purgatives and blisters, should be avoided. The warm bath should be used every day. Belladonna, conium, bromide of potassium, henbane, opium, and oxide of zinc, also valerian, assafœtida, and musk are useful remedies in this affection, as in convulsions. The course of the disease is favorable. Mere fumigation with juniper berries often effects a cure by relieving pain and contraction of muscles. In severe cases inhalation of chloroform may be tried, or chloral internally.

ATHETOSIS.

This term has been applied to a variety of local spasms affecting the fingers and toes. The patient is unable to keep them voluntarily in any fixed position. They are subject to constant slow, tonic spasmodic movements, even when the limbs are generally at rest. During sleep the movements cease in some cases, in others they do not, or the fingers and toes remain in abnormal positions. In a majority of cases the disease is confined to one side. Rarely both sides are affected. The affection generally follows hemiplegia, and then the paralysed side is chiefly affected. It is invariably associated with hemi-anæsthesia.

Causes.—The disease occurs generally in middle life. It occurs in the intemperate and the epileptic. The subject is always weak in health. Spasms sometimes may be due to local causes, as injury or accident to the nerve or disease of the nerve.

Symptoms.—The condition is characterised by a continued, slow, forcible and coordinate movement affecting the fingers and toes. The movement is arrested for a time in certain positions under influence of the will, but is soon renewed with increased force. The disease sets in gradually and insidiously. Sometimes the onset is sudden, and in some cases with a convulsion. The patient on voluntarily moving the fingers and toes perceives the occurrence of the peculiar spasmodic movements. After a time the movements become continuous. The movements are peculiar. There is at first flexion of the third over the second phalanx, then the second flexes on the first, till the whole finger flexes on the metacarpus. They then reopen or extend in the inverse order. Thus the first phalanx extends from the metacarpus, then the second, and lastly the third, till the finger extends to its utmost, so much so indeed that the tip of the finger points completely backwards. During sleep or rest the flexion is more continuous, and the hand remains firmly closed. The toes are more or less similarly affected, and are extended just as the fingers are flexed. Very often the great toe is curved; sometimes it is firmly flexed, and the rest of the toes are extended. When the condition is severe, the muscles of the arm and forearm become implicated, and also those of the legs. The upper limb is more rapidly affected than the lower. The arm may be extended, and pronated or supinated, or drawn spasmodically backwards. The leg, when affected, is rotated outwards, and the patient walks with great difficulty, or on the balls of his toes. In rare cases the patient walks on the outer edge of the foot. Notwithstanding such an extensive muscular effort there is no fatigue of the muscles, as occurs in writer's cramp. The rigidity is only temporary. The spasm may cause pain. The muscles sometimes become hypertrophied. Sensation is often impaired.

Pathology.—There may be two factors in this disease; 1st, there is a continuous evolution of nerve-force exceeding that in health; 2ndly, the movements are incoordinate. The peculiar movements can be thus explained. During health, when the mind wishes to do any act or to effect any movements, an idea is first formed in the brain. The will puts it into action; to effect this, a certain amount of nerve-force is liberated from certain nerve-centres situated on the surface of the brain. This nerve-force is supposed to be guided by some of the nerve-centres, as the corpus striatum and optic thalamus, &c., into proper channels. In athetosis the sudden onset and slight impairment of sensation, show that a lesion, damaging a portion of one of these nuclei, leads to perverted action of nerve-cells. The nerve-force flows out into different channels indiscriminately, and thus the current, which is always slow and continuous, passes into different motor nerve-filaments generating abnormal motor impulses, and exciting the corresponding muscles in an incoordinate manner.

Morbid appearance.—The mischief is generally located in the brain. The corpus striatum and optic thalamus are chiefly involved. In one case a cyst was found pressing upon the corpus striatum.

Prognosis.—It is very unfavorable.

Treatment.—The cause should be sought for and treated. If due to syphilis large doses of iodide of potassium will sometimes suffice for a cure. The affection can sometimes be traced to some disease of the nerves. Nervine tonics and sedatives are indicated. Another chief indication is to allay the paroxysms, and, if practicable, to prevent their occurrence. When the spasms are violent and continuous, relief is sometimes obtained by the hypodermic injection of morphia. If anæmia coexists, ferruginous tonics may be added. Sleep may be restored by Indian hemp or bromide of potassium. As nerve-tonics, strychnia, various preparations of zinc and even arsenic, have been given with good results. If the disease is chronic, electricity will be the best remedy. Faradisation and the continuous galvanic current have both been successful. The latter is chiefly recommended. The positive pole may be placed on the spine or brachial plexus, and the negative pole on the affected muscles.

NEURALGIA.

Neuralgia means some affection of a nerve, whereby the circumscribed parts to which it is distributed become the seat of more or less severe or agonising pain. It signifies nerve-suffering, and implies a painful disorder apparently unconnected with inflammation or recognisable organic change in the affected skin, mucous membrane, or viscera. There is morbid exaltation of sensibility, and the sensation of pain is due to abnormal irritation of the sensory nerves. The excitation is conducted to the brain. The irritation affects the trunk of a nerve, or main branches, and sometimes the peripheral expansion of nerves; and the pain occurs in the course of a nerve, or in the area of its distribution, without the perceptible action of an irritant on the nerve itself or on its terminations. The parts immediately adjacent, and supplied by other sensory nerves, are free from pain. Where the lesion, or the irritation, as a blow, affects the peripheral termination of a nerve and causes pain, this pain is not neuralgic. In neuralgia the pain is often accompanied by a variety of other sensations, and patients complain of burning, itching, tingling, &c. Sensitiveness of the skin to pressure and temperature is often altered. Complicated cases occur in which nerve-inflammation and neuralgia exist together. In these, inflammation of the nerve-fibres is the immediate cause of pain. In neuralgia there is not only pain and a sensation of burning, but sometimes of coldness. Periodical cephalalgia or sick headache is not a pure neuralgia; in this affection, some lesion is probably situated in the cranial nerves.

Causes.—In one form or another neuralgia is very prevalent throughout the world. It may be caused by (1) any wound, amputation, or other injuries affecting a nerve; (2) impaction of foreign bodies near the nerve, leading to irritation; these give rise to traumatic neuralgia. (3) Pressure on some part of the nerve, as of a tumour, malignant or otherwise (uterine); intestinal accumulation; distended veins and osseous growths, syphilitic gummata, &c., as occur in bony channels. (4) Disease of nerves, as inflammation of nerves and neuroma. (5) Morbid state of the sensorial nerve-centres. (6) Compression of nerves as by cicatrices. (7) It may be a symptom of various morbid states of the blood, the result of malaria, cachexia, anæmia, rheumatism, or syphilis. (8) Poisoning by metallic substances, as lead, copper, mercury, also leads to it. Neuralgia is often hereditary. Cases occur in which, though the disease is severe and incurable, no source of irritation whatever can be detected. In some cases severe neuralgia accompanies disease in one portion of the body, but is felt in some remote part. Thus in hip-joint disease, the pain is referred to the knee; in abscess in the liver, to the shoulder; in calculus in the kidney, to the testicle or urethra. In decayed teeth, the pain is sometimes over the eyebrow. In stricture of the urethra and in piles, the patient sometimes has violent neuralgia of the foot. There is pain down the left arm in angina pectoris, and along the little finger from pressure of the ulnar nerve at the elbow. The disorder is very often induced by the most trivial causes; the slightest touch or breath of air on the spot will sometimes excite the severest pain. The disease is more common in women than in men, and in the weak and debilitated than the strong and robust. Nervous debility is the chief predisposing cause. Hysterical subjects often complain of neuralgic pains.

Symptoms.—A person in apparently good health is seized with a violent pain in some part of the body. Pain is the only symptom as a general rule, and may be felt at the seat of mischief or elsewhere. In intercostal neuralgia the pain is felt on the affected side, and is often accompanied by an eruption of shingles or herpes zoster. In cancer of the breast the pain is felt in the mamma affected. Similarly in tabes dorsalis and caries of the spine, the pain is in the spine. It may be diffused over an extensive area if the branch of the nerve affected is large. Limitation of the pain to a circumscribed spot shows that only a small branch is implicated. The pain occurs at different intervals, and usually increases in intensity at night. When the nocturnal exacerbations are a marked symptom, syphilis or the effects of malaria may be suspected. The severity and persistence are out of proportion to the extent of the nerve-lesion. The pain is intense and protracted where the tissues surrounding the nerve trunk are injured. It sometimes occurs at equal intervals, and may be referred to parts which have ordinarily no sensibility, as the heart. It is generally distributed to the peripheral expansion of nerves. Thus those branches of the fifth pair of nerves which are distributed to the skin of the face are the most frequent seat of neuralgia (tic douloureux). In hemicrania, certain portions of one side of the head are attacked; in sciatica, the parts where the branches of the sciatic nerve are distributed are the seat of pain. In intercostal neuralgia, the spaces between the ribs are exquisitely painful. In the thorax, neuralgia is most prone to be severe in three circumscribed spots. 1. That part of the spine where the nerve emerges. 2. The side of the chest where the nerve divides. 3. The breast-bone where the nerve ends. Those branches of a sensory nerve supplying the viscera are also liable to neuralgia; as of the heart (angina pectoris), stomach (gastrodynia), kidney (nephralgia), liver (hepatalgia), intestines (enteralgia), or mamma (mastodynia).

Characters of the pain.—The pain is of the most varied character. It may vary from slight tingling, or feeling of burning or coldness, to severe cutting, piercing or throbbing pain. It is often attended with one or several repeated shocks like those of electricity. The pain is often so severe as to cause patients to scream or to utter loud shrieks. The pain may be continuous or paroxysmal, or may return in the part with renewed violence after periods of temporary remission. There are two kinds of pain, one of them is continuous. It is fixed and confined either to one small point or to several circumscribed points in the course of the nerve. The continuous pain is increased by pressure, and is not very severe, but is more of an annoying or dull character. There is tenderness in the course of the affected nerves or of their distribution. The tenderness is often limited to certain spots, and these from observations have been determined to be points at which the diseased nerve emerges, as from canals or some dense fascia that the nerve has perforated. These pains when limited to a spot can sometimes be relieved by firm pressure. It is common for intercostal neuralgia to involve one half of the body. In many cases with this sudden pain, there is associated impairment of cutaneous sensibility, more or less alteration of reflex movements and twitchings, or spasms of the affected muscles. Thus in pain in the toe, the leg is drawn up. In tic douloureux, the spasms of the muscles of the face occur. The second is the radiating or flying pain. In it the paroxysms of the attack occur suddenly, then cease suddenly and again return in a few minutes. The attack is supposed to consist of several short twinges, the pain spreading along the course of the nerve. In it the pain is sometimes excruciating. It sometimes involves a morbid condition of sensorial nerve-centres, and may be due to blood-poison, as gout or malaria. This kind of flying pain is always accompanied by muscular spasms.

In neuralgia we often notice changes in the blood-supply of the part, also anomalies in the secretion and nutrition. This is chiefly illustrated by the increase of secretion of the lachrymal glands and of the glands of the mucous membrane of the mouth in cases of facial neuralgia. In the commencement, there are no signs of inflammation; on the other hand, the affected surface of the skin often becomes pale, but at the height of the attack the skin often becomes red and congested, and frequently the arteries and veins of the affected parts become dilated and throb. Affections of sensory nerves also lead to nutritive changes. These are illustrated by certain exanthemata as erythema, herpetic eruptions, atrophy, or wasted condition of the parts, and occasional discoloration of hairs. In intercostal neuralgia we find eruption of shingles, herpes zoster. Neuralgias have a tendency to be unilateral or unsymmetrical; one side of the face, or one side of the nose alone, is affected. They also have a tendency to shift from day to day, and from place to place, and even from one branch of a nerve to another. In cases of trifacial neuralgia, the pain may shift to the occipital nerve or to the brachial plexus. It is a matter of surprise that the health of the patient generally suffers only after the disorder has continued for some time. There is often some coexisting morbid condition, as anæmia, gout, rheumatism, syphilis, hysteria, or the effects of malaria. Except in cases due to malaria the disease is generally chronic and irregular, and paroxysmal, with remissions and exacerbations. The attacks often occur spontaneously, and even slight irritation of the skin by pressure or friction sometimes induces a paroxysm. In many cases mere movements of the affected parts excite pain. The duration of the paroxysm varies from a few seconds to several minutes. The attack may continue for several hours or days with remissions. Where the attacks are long, patients describe their sufferings as made up of many short paroxysms. All explanations about the neuralgic pain being not a one continuous whole but embracing several intervals of ease, are purely hypothetical. Physiologists suppose that severe irritation of a nerve is generally followed by a state of diminished excitability, and that after severe attacks of pain the peripheral ends of nerves become for a time less sensitive to irritation. We also notice the fact that by continued and strong pressure on a painful part (neuralgic) the pain is increased at first but is subsequently very much diminished.

Types of neuralgia.—1. Genuine or pure neuralgia. It is due to an unknown cause. It is a violent pain in the trunk or branch of a sensory nerve, occurring in paroxysms, often at equal intervals, and being frequently referred to parts which ordinarily appear to possess no sensibility, as the heart. The pain is acute, and frequently confined to one particular spot, or is shooting or darting, with tenderness of the part upon pressure, but no heat, no throbbing, no swelling of the blood-vessels. It is often accompanied by muscular spasms.

2. Rheumatic neuralgia. It is a most protracted disorder, modified by the rheumatic diathesis. The symptoms are heat, pain and tenderness along the course of an affected nerve, attended by a constant dull aching sensation, increased at intervals. There is no spasmodic action of the muscles or nervous twitchings over the part. The disease generally continues for many years.

3. Hysterical neuralgia. There is extreme sensibility of the skin. The tenderness may be circumscribed, but is often diffused over a large extent of surface. The suffering often amounts to agony. Upon examination the sensation of pressure and temperature of the skin is found quite natural. The pain is seated in the skin and not in the exact course or distribution of one or more sensory nerves. When the patient's attention is drawn to the part the pain is much increased.

4. General neuralgia. It affects sometimes one place sometimes another. The face, the hips, perhaps the back or thorax, are successively invaded. The pain is very severe, paroxysmal, with a frequent tendency to periodicity. It generally occurs in marshy districts, and the attacks are sometimes connected with exposure to cold, the state of the atmosphere, and the condition of the abdominal organs. In England neuralgia is most common and severe in the fenny districts of Lincolnshire and Cambridgeshire; but as a general rule neuralgia is more common among dwellers in towns and in those who lead a sedentary life. During the prevalence of easterly winds neuralgia is especially apt to attack those who are liable to it.

Treatment.—In every case of neuralgia attention must be directed first, to finding out the cause, and if practicable, to removing it. Where the disease is of a malarial origin, quinine produces brilliant results. In cases accompanied with rheumatic diathesis or history of rheumatism, a systematic use of medicated or artificial or natural warm baths may be prescribed with benefit. In them relief may sometimes be obtained by sea-bathing, and by sulphur and other mineral springs.

In poisoning with copper, mercury, and lead, sulphur given internally and sulphur-baths prove extremely useful. Secondly, attention must be directed to the condition of the parts affected. Neuralgia invariably leads to change of tissue and nutrition. These modifications can be best averted by electricity. Both the induced and constant currents are in use. In using the induced current, one pole is employed in the form of an electric brush, and a piece of wet sponge is attached to the other. The sponge being held in the patient's hand, the brush is passed along the course of the affected nerve. From ten to fifteen applications are enough at each sitting. Generally, after one or two sittings, the pain is considerably relieved. Its effect upon the skin is by derivation, like blisters, frictions &c. The constant current is very highly extolled by eminent practitioners, and more cases of cure by this are recorded than by the former method. In the use of the constant current both poles may be placed along the course of the affected nerve. The third object is the destruction of the excitability of the nerves. For this purpose the treatment is both palliative and curative. As a palliative the chief object is to relieve the pain. This can be effectively done by the internal administration of drugs, by inhalation, and by local remedies. When the pain is severe and the patient in violent agony, inhalation of chloroform or ether is advisable. Many give brandy-and-water before the inhalation is commenced. Internally opium is the best remedy to be relied on. It should be given either by the mouth or the rectum, or may be injected under the skin. Some have recourse to the injection of ten or fifteen drops of chloroform or of a quarter to half a grain of morphia in the neighbourhood of the affected nerve, as a palliative measure it is often very useful. Where the paroxysm of pain is not very severe, hydrate of chloral with or without opium, or with belladonna or with atropine will suffice. Locally, compresses of cold water or of evaporating drugs are of great service. Sinapisms and fomentations are useful. Other local applications as painting of the skin with a solution of hydrate of chloral and camphor equal parts, or friction with liquid extract of opium, ointment of belladonna, aconitia, gr. j. to ʒj butter of cacao, or veratria gr. ½ to ʒj lard, or chloroform liniment are often serviceable. The part should afterwards be left at perfect rest.

The local application of turpentine or of kerosine oil answers well in a few cases. Counter-irritation, as small blisters, or cauterisation side or certain parts of the head. It is frequently associated with nausea and bilious vomiting. The French call it migraine. It is essentially a periodic disease, and occurs with more or less regularity at certain periods. Bad health favours its production. It often ceases during pregnancy, suckling, or change of scene or occupation. It is more common in women than in men; and in women when exhausted by over-lactation or by menorrhagia, or when suffering from uterine disorders. It generally ceases at fifty or sixty. The disease is often hereditary; it sometimes commences at puberty, but it may occur at any age between two and thirty years; it seldom commences after fifty. It is often excited by derangements of the stomach, due to overfeeding or prolonged abstinence; by excessive mental or bodily work; by excesses of any kind; by insufficient or long hours of sleep, and by want of some attention to sanitary and hygienic laws. Various morbid impressions upon the eyes or ears or nose, as glaring lights, discordant noises, or offensive smells, and even undue exposure to the sun very often lead to it.

According to the chief clinical phenomena, headache is divided into—1, organic; 2, congestive or plethoric; 3, nervous or hysterical (clavus hystericus), rheumatic, syphilitic; 4, malarial; 5, bilious; and 6, sick headache or migraine. Organic or structural headache occurs as a symptom of irritation of the sensory nerves of the brain. Some suppose it to be due in these cases to irritation of the filaments of the trigeminus distributed to the dura mater. It is also caused by gout, syphilis, and rheumatism. It may be due to inflammation of the meninges, cerebral abscess, cerebral tumours, aneurism of the cerebral arteries, and to extension of inflammation from without. It may be premonitory to cerebral softening. Meningeal headache is generally associated with cerebral symptoms, as vertigo, vomiting, noises in the ears and intolerance of light, strabismus or ptosis. The ophthalmoscope often reveals changes in the optic disc. The mind is confused, so that the exercise of the intellectual faculties is almost an impossibility. The pain is very acute, fixed, continuous, or habitual. In tumour and in cerebral abscess it is intermittent. Movements of the head, as stooping, or the recumbent posture, increase it. It is lessened by elevating the head. The locality of pain corresponds with that of the lesion.

Congestive headache occurs in different persons, the symptoms varying with the greater or less amount of congestion of the cerebral vessels. Headache may be due to passive congestion, as produced by asthma, derangement of the liver, bowels, and skin; or resulting from the effects of alcohol. It may arise from causes which produce a debilitated state of the cerebral vessels, as anæmia, exhaustion due to hæmorrhages and chronic discharges, as leucorrhœa, excessive mental or bodily work. When due to anæmia the pain is confined to the top of the head or across the forehead. Such cases are known as anæmic headache. Active congestive headache occurs in persons of sedentary habits accustomed to too full a diet and very little exercise. It may also be due to hypertrophy of the left ventricle of the heart, to general plethora and mental excitement. It is very common in women where the menses are suppressed, and in cases of suppression of habitual or chronic discharges. In hydrocephalus children often shriek and awake out of sleep from pain in the head. Active congestion is characterised by a general plethoric state of the body, a full pulse, injected eyes, and flushed face. The pain is peculiar, it is dull and obtuse, affecting the whole or part of the head, and particularly the forehead or occiput, and is often associated with giddiness, which increases on stooping. There are sensations of pulsations and throbbing in the ears.

Pathology.—The pathology of headache is purely hypothetical. Some refer the affection to an abnormal condition of the sympathetic nervous system, and to affections of the vasomotor nerves. Owing to fatigue or causes which lower the general tone of the body, the regulating power of the cerebro-spinal over the sympathetic is impaired, and excitement of one or more portions of the sympathetic takes place; the influence of the altered condition of the affected portion on the cerebral vessels causes them to contract, and leads to disorder of the circulation of the blood in the nervous centres, which thus become anæmic. It is supposed that to this disordered circulation the defects of vision and other early premonitory phenomena of megrim are due. The headache is referred to the exhaustion, consequent upon excitement of the sympathetic, which is generally attended by secondary hyperæmia and dilatation and throbbing of the temporal arteries. Other observers contend that in headache, besides anæmia and subsequent hyperæmia of the brain, there must be some antecedent cause to produce affections of the vasomotor nerves. This cause is supposed to be irregular accumulation and discharge of nerve-force, or "nerve-storm." This nerve-force traverses more or less of the sensory tract, from the optic thalami to the vagus. The disease is chiefly seated in the optic thalamus, and in those parts of the brain which lie between it and the roots of the vagi. At one time the disease was regarded as a form of neuralgia, but in migraine there is a greater disturbance of the sensorium. The pain spreads over the head, and is associated with nausea and vomiting. Headache was also regarded as an affection of the liver or of the stomach; but attacks of megrim side or certain parts of the head. It is frequently associated with nausea and bilious vomiting. The French call it migraine. It is essentially a periodic disease, and occurs with more or less regularity at certain periods. Bad health favours its production. It often ceases during pregnancy, suckling, or change of scene or occupation. It is more common in women than in men; and in women when exhausted by over-lactation or by menorrhagia, or when suffering from uterine disorders. It generally ceases at fifty or sixty. The disease is often hereditary; it sometimes commences at puberty, but it may occur at any age between two and thirty years; it seldom commences after fifty. It is often excited by derangements of the stomach, due to overfeeding or prolonged abstinence; by excessive mental or bodily work; by excesses of any kind; by insufficient or long hours of sleep, and by want of some attention to sanitary and hygienic laws. Various morbid impressions upon the eyes or ears or nose, as glaring lights, discordant noises, or offensive smells, and even undue exposure to the sun very often lead to it.

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Symptoms.—Headache is generally ushered in by some precursory symptoms of the character of disordered sensations. These last for about half an hour or an hour. The patient experiences a sense of malaise, depression of spirits, great uneasiness, coldness of hands and feet, chilliness, irritability of temper, yawning, disinclination for food and drink, and a slimy taste in the mouth. Sometimes vision becomes temporarily impaired, the visual area is confused, it has, as it were, a zigzag outline, and often in the centre of the field of vision there is a dark spot which spreads into a wave. All these sensations the patient knows from past experience to be premonitory; a sense of general chilliness with cold feet or mental depression is the most common precursory symptom. In some cases the patient, whilst in the midst of social enjoyment, on waking from sleep, or after rising in the morning, is suddenly seized with a dull pain, localised immediately over the lower edge of the eyebrow or in the lower part of the temple. The pain varies in intensity and character in different paroxysms. The headache or the pain may be constant or intermitting, somewhat diffused or localised in the frontal, temporal, or occipital regions. It may be superficial or deep, may be felt as a sense of weight on the top of the head, or amounting to a sense of constriction. It is often extremely severe and unbearable, and described as throbbing, shooting, or boring, as if a point in the temple were being bored with a gimlet, or the head feels as if going to burst, or it may be heavy, dull, and aching. As the headache increases the ocular disturbance grows less, but the patient cannot bear light or sounds. Nausea is felt; retching and vomiting sometimes give relief. The head throbs; the pain is aggravated by movements, change of posture or muscular exertion, as mastication, efforts in straining, stooping, coughing or sneezing. With the pain the nausea and vomiting increase, the mouth feels clammy, the skin over the eye and of the scalp are both painful and tender when touched, often the arteries of the affected part are dilated and throbbing. The pain is generally confined to one side, and when it affects both sides one side is more painful than the other. Occasionally it attacks the back of the head instead of the scalp; sometimes it is diffused. The face is sometimes pale, at others flushed. The head is hot. The eyes are watery and often bloodshot; the eyeballs ache, and are often tender to pressure. The pulse is soft and slow, and the pupils are contracted and unequal. The pain is relieved when the patient falls asleep. On awaking he feels listless and weary, but generally the headache has ceased, only slight tenderness being left behind. He either perspires profusely, or passes large quantities of pale limpid urine. The paroxysm may last for a few hours only. It may recur after a variable interval of days, or weeks, or months, differing in each case. The recurrences are often spontaneous; they may be due to very slight causes, as undue mental excitement, want of proper sleep, imprudence in eating and drinking.

During the interval the vision is sometimes obscure, and the patient cannot recognise the faces of persons at whom he is looking, or he observes various coloured oscillating spectra before his eyes. Besides the sense of sight, other senses, as of hearing, taste, or smell, also become perverted. There may be also anæsthesia or dysæsthesia of the skin of the affected side of the head, neck, and face.

Diagnosis.—Headache is diagnosed from rheumatic affection of the scalp by the tenderness of the skin in the latter complaint, and by the existence of rheumatic pains in other parts. From syphilis by the affections of the periosteum or bone. In syphilitic cases there will always be glandular enlargement, and other coexisting symptoms. From inflammation of the scalp by commencing erysipelas. From ordinary neuralgia by the implication of the supraorbital or the cervico-occipital nerve. In neuralgia the attack is of a longer duration, and the interval is more complete. In some cases of neuralgia motor paralysis is superadded. Generally at the close of the attack of headache, but rarely from the commencement, drowsiness occurs, which often merges into partial coma, the patient feeling dull and mentally confused for several hours afterwards. In some cases considerable excitement precedes the attacks.

Treatment.—The treatment of headache varies with the cause. Where the headache is due to some morbific agent in the blood, the poison must be sought for and removed. In congestive headache, which is generally due to disease of the heart or lungs, the cure can only be effected by relieving the associated morbid phenomena. Where the gouty condition is present colchicum does good. Stimulants should be avoided in most cases, but they may be given in headaches due to nervous exhaustion. In them oxide of zinc in from two- to five-grain doses and nitrate of bismuth have been prescribed with benefit. For bilious headache purgatives and alkalies are indicated. The irritation of the stomach is best relieved by liquor ammoniæ acetatis. Where headache is due to uterine disorders tincture of veratrum viride, cautiously given at the menstrual period, is likely to be beneficial. In the congestive headache tincture of aconite in one-minim doses given every hour is often useful. Ergot may be given as an abortive or palliative remedy. In nervous headaches in women, if during the menstrual period there is associated constipation or dark stools, purgative doses of podophyllin often afford relief. In organic headache, if due to diathesis, as gout, or syphilis, the cause must be treated. If due to inflammation of the meninges, the patient must be kept in a dark and quiet room with cold applied to the head. If the pain is very severe leeches may be applied, or drastic purgatives administered. Iodide of potassium given in ten-grain doses every three or four hours sometimes relieves headache of a throbbing character, and associated with intolerance of light and preventing sleep.

In hemicrania, or where the throbbing pain is confined to one side, or one brow, arsenic is useful. It should be steadily given for a long time. In young women, where the pain is confined to the eyebrow and in the eyeball, and especially if there be gastric or uterine derangement, extract of belladonna with extract of cannabis and valerianate of zinc are found useful. Some prescribe guarana powder (prepared from the seeds of *Paullinia sorbilis*). Where the disorder assumes a periodic or intermittent character, quinine in doses of two or three grains twice or thrice a day gives relief. In such cases arsenic is also of great service.

During the paroxysm, if the head be hot and the face flushed, ice or eau de Cologne may be continually applied. In severe cases leeches to the temple may become necessary.

Treatment of migraine or sick headache.—Attempts should be made to diminish the force of the paroxysm, and also to lessen the frequency of recurrences. The remedial measures employed are both palliative and curative or preventive. A paroxysm may sometimes be cut short by a laxative given just as the pain begins. In mild cases hot drinks, as a cup of tea or coffee, relieve it. Often cheerful society or conversation, or a little healthy exercise, relieves headache. Quinine in ten-grain doses sometimes has a similar effect. It arrests the fit, or if it fail, it lessens the severity of the paroxysm. Bromide of potassium in large doses, combined with hyoscyamus and aromatic spirit of ammonia, procures sleep, and thus gives relief to pain, or shortens its duration. Opium sometimes has a similar effect. Chloride of ammonium, in fifteen-grain doses, produces marked relief. In severe cases, where there are disturbances of vision, the paroxysm is often cut short or reduced by caffeine or guarana powder. The latter may be given in fifteen-grain doses every two hours. Where the headache is severe, inhalation of the nitrite of amyl is recommended. Carbonate of ammonia, or liquor ammoniæ acetatis, is sometimes useful to relieve headache. Other palliative measures are rest in a dark and quiet room, and avoidance of sound and light, movements which produce gastric uneasiness should be interdicted. Sinapisms to the back of the neck afford relief in some cases. Very often relief is obtained by a gentle emetic. As a rule it is better to check vomiting by hydrocyanic acid or citrate of potash. Various local applications, as anæsthetics and anodynes, do good sometimes. The patients sometimes firmly hold their heads with their hands, and in so doing induce marked cerebral congestion, and thus the headache is relieved. They also tie a tight band across their forehead, or to the tender or aching part. Poultices of bran or linseed over the scalp sometimes give relief. Cold effusion, evaporating lotions, and the application of a saturated solution of camphor in eau de Cologne are sometimes tried with benefit. These act by constringing the vessels and diminishing the blood-supply. In intense persistent headache, a few leeches to the temple rapidly give relief. If the head is hot and the feet cold, fomentations or ice-bags to the head, or a hot-water bath to the feet and legs, or a mustard foot-bath will relieve the symptoms in many cases. Oil of peppermint or ginger powder rubbed over the scalp is sometimes tried with advantage. A mustard plaster to the nape of the neck also relieves the pain, especially when the acute attack has subsided. The application of extract of opium to the forehead or temples sometimes gives relief. Where all the remedies fail, Faradic electricity and the constant galvanic current have been employed, but the results are not always satisfactory.

The curative treatment.—This treatment is useful during the interval. The chief indications are—1, avoid as far as possible the exciting causes; 2, remove any complication or the disorder which may be supposed to keep up headache. Anæmia and disorders of digestion ought to be treated and removed. The chief remedies for this purpose are iron, strychnine, and cod-liver oil, and also vegetable bitters. In every case give tone to the bodily and nervous systems. The diet should be such as can easily be digested and assimilated. Abstinence from nourishing diet and restrictions to various articles of digestible food often aid in decreasing the severity and frequency of the paroxysms. Indulgence in tea or coffee, abuse of alcohol or tobacco, should be interdicted, as they increase dyspepsia, and in many cases act as exciting causes. Vegetable bitters, combined with spirit of ammonia, are generally useful in sick headache. A combination of quinine with digitalis given every morning sometimes prevents megrim. In many cases, and especially where there is defective action of the liver, the dilute nitro-muriatic acid, combined with nux vomica and calumba, and taken for some time twice daily before meals, will be found to diminish the frequency of the attacks.

FACIAL NEURALGIA.

Tic douloureux (faceache), otherwise called prosopalgia, epileptiform neuralgia, is the most severe and frequent form of neuralgia. The word *tic* signifies convulsive twitchings of the skin. It is usually confined to one side of the face. It may affect the whole nerve or only a filament of either of the three chief branches of the fifth nerve (trigeminus).

Causes.—The disease is one of adult life, is more common in women than in men, and is for the most part of life-long duration. Its frequency may be accounted for by the peculiarities of the distribution of the nerve. 1. Its branches are spread over a large area of the skin of the face, the parts most freely exposed to the influence of cold. 2. They also run through several foramina and narrow bony canals, which are very apt to become compressed or narrowed from the most trivial causes. The disease may often be traced to causes of neuralgia in general; to general debility; to blood-poisoning, as from lead, and to exposure to great heat or cold. Malaria is a very frequent cause. Hysterical patients frequently suffer from facial neuralgia. Disease of the bones of the skull, as thickening, exostosis within the skull, tumours, or any other organic brain-disease pressing on the nerve, or a morbid condition, as caries or necrosis, of the teeth to which the nerve is distributed, may all give rise to faceache. In some cases abnormal development of the teeth leads to it.

Symptoms.—The disease lasts a long while, except when due to malaria, in which case the duration is short. The pains are usually burning or shooting like sudden electric shocks; they may vary from mere tingling to agony so severe that they prevent all attempts at repose. As a rule they cease during sleep. The pain may be limited to the course of the nerve, or may, by sympathy, involve other nerves, and thus may be radiated from the original seat. Some patients suffer from a constant or a permanent dull pain at different points of the nerve; others from an agonising excruciating pain which occurs suddenly every few minutes. It is generally paroxysmal, and is apt to be brought on even by a breath of cold air or spontaneously. It may be felt at different points of the trigeminus. It is more extensive when several branches of the nerve are affected, and limited when a very small branch is the seat of disease. Where the pain is extensive, it shows that several filaments are involved and that the mischief is within the skull. In limited cases its origin is supposed to be peripheral.

Seat of pain.—It is seated over any of the parts supplied by the sensory filaments of the fifth. Thus it may extend over—1, anterior surface of the ear; 2, skin of the forehead, temple, face, in the eye, nose, palate, tongue, teeth, &c. The pain is often accompanied with changes in the secretion and nutrition of the parts supplied by these filaments.

The seats of the morbid condition may be summarily classed under three heads. They all lie in a vertical line and are named—1, supra-orbital; 2, infra-orbital; and 3, inferior dental or inferior alveolar. Affection of the supra-orbital or ophthalmic or the first branch gives rise to pain in the forehead, eyebrow, and upper eyelid. In a few cases the pain is in the eye, at the inner canthus and in the caruncula lachrymalis. It is often accompanied by lachrymation and redness of the conjunctiva, an occurrence which lasts after the paroxysm is over. When due to malaria, the pain is regular and paroxysmal, and is known as brow ague. It is then recognised partly by its periodic character, partly by the supervention of a distinct cold stage, and partly by its occurrence in persons living in a marshy locality. In such cases the pain is chiefly confined to the neighbourhood of the supra-orbital foramen. When the second, infra-orbital, or the superior maxillary branch of the trigeminus becomes affected, we find excruciating pain shooting over the lower eyelid, alæ of the nose, in the teeth of the upper jaw and upper lip. The patient often finds difficulty in mastication, and there is increased secretion from the nose. This neuralgia may exist alone or may accompany the first form. The third, infra-maxillary, or the infra-dental neuralgia, is more rare. It may occur in the course of the auriculo-temporal and the lingual nerve. It is more frequent in the inferior alveolar, or mental, and gives rise to pain in the lower lip, teeth of the lower jaw and chin. It is sometimes accompanied with profuse flow of saliva. All these pains are often accompanied by muscular spasms. Sometimes the patient strikes his forehead with his hands, sometimes he chews his lips to relieve pain; at others, the severity of the pain drives the patient to commit suicide. As a rule the disease does not tend to shorten life. The lingual branch of the fifth is not so often affected as the other portions; neuralgia in this branch is of a very excruciating character. The attacks cause paroxysms of agony. The taste is not affected, but the pain is attended by spasmodic movements of the facial muscles.

Treatment.—Facial neuralgia requires attention to the three chief indications already given, while treating of neuralgia in general. 1st. Remove the cause, if possible. In only a few cases we can diagnose foreign bodies pressing upon the nerve. These if present should be removed. The teeth should be examined and decayed teeth or stumps should be extracted. Opium in any form or its alkaloids may be given in large and repeated doses. The hypodermic injection of gr. ⅛ of morphia is the best mode of administering it. Alcohol is often resorted to in these cases to relieve pain. Hot brandy-and-water often acts with benefit. Croton chloral is a very effective remedy. It may be given in three-grain doses every two hours while the pain lasts. The chloride of ammonium in ʒss doses is also very useful. When the pain is of a rheumatic character, anti-rheumatics, as the iodide of potassium, may be prescribed. In some cases where the disease is of a malarial origin quinine does good, and where quinine fails arsenic may be substituted. The sesquioxide or the carbonate of iron and the tincture of gelsemium are worth trying when the neuralgia is associated with nervous debility and anæmia. Nux vomica, phosphorus and strychnia are favourite remedies; these act by nourishing the nervous system and also check the tendency to periodicity. Where the neuralgia is dependent on disorder of the stomach and bowels, croton oil with compound extract of colocynth is of benefit. Arsenic is very beneficial in hysterical cases. Nitrate of silver from ½ to gr. j doses has been tried in a few cases with good results. In India the good effects of dhatura, conium, cannabis, belladonna, and even tobacco are well known. Oxide of zinc with cannabis and hyoscyamus forms a very valuable combination. Sleep may be produced by hydrate of chloral. Above all, arsenic, with bark or quinine, although slow in its effects, is a very useful medicine. It operates most favorably on persons of relaxed fibre, whose secretions are profuse and skin is cold and moist. Locally, in recent cases, or those due to exposure to cold, flying blisters, mustard plasters, and the liniments of aconite, veratria, opium, or belladonna may be recommended. Many inject atropine $\frac{1}{30}$ of a grain with arsenic $\frac{1}{30}$, and ¼ to ½ a grain of morphia. Others use morphia alone hypodermically twice a day as above mentioned, and it is a valuable remedy. In localised neuralgia, superficial cauterisation by the hot iron is sometimes of great service, and the galvanic current is a most potent remedy. The interrupted (faradic) current must not be used. The application is stimulating and exerts its influence by exhausting the local nervous excitement. It also prevents changes in the nutrition of the affected parts. The division of the nerve (neurotomy) is an operation more often practised in this than any other form of neuralgia. Favorable cases for neurotomy are those where (1) the pain is very limited, (2) where other treatment has failed entirely, (3) the pain so severe as to prevent rest or any movements with ease, (4) the pain never occurs spontaneously, (5) the seat of mischief is at a point beyond which the nerve is accessible to the knife. Another equally palliative remedy in neuralgia is compression of the affected nerve and the artery supplying it. It deserves trial in well-selected cases. Nerve-stretching has been tried in a few cases, and with very satisfactory results. It appears to be essential that both the central and the peripheral portions of the nerve should be pulled with considerable force. Some amount of cutaneous anæsthesia, lasting only a few days, ought to follow the operation. This method has been successful in cases in which all other remedies had been tried without effect.

NEURALGIA OF THE NECK AND TRUNK.

Neuralgia of the neck is otherwise known as cervico-occipital neuralgia. The disease originates in the first four cervical nerves. It is a common complaint among the people of India. The disease is characterised by an uneasy sensation, amounting to a dull heavy continuous pain, limited to small spots, or by severe electric-like shocks in the upper and back part of the neck. It is a neuralgia of the sensory nerves of the occiput and neck. The pain is confined to a fixed spot between the mastoid process and the spine, and there is frequently some tenderness on pressure. It sometimes radiates in various directions. It may extend inwards to the back of the head below the occipital bone, or between the mastoid process and the first cervical vertebra; forwards to the face or between the trapezius and the sternal muscle or somewhere about the middle of the neck; downwards to the shoulder or as far as the chest. The affection is most common during the winter, the disease often begins after a long exposure to cold of that part of the neck lying between the hat and the coat. It is often confounded with rheumatism. Rheumatism is a purely muscular pain in the nape of the neck which is always tender on pressure. In it only the small muscles and fibrous tissue at the back of the neck are in agony. There is great difficulty in rotating the head. The pain is only dull and heavy but never darting or spasmodic as in neuralgia. In rheumatism the temperature is somewhat raised. The neuralgia may be due to diseases of the vertebræ, to swelled lymphatic glands in the neck. These are apt to press on the cervical plexus and occipital nerves and cause pain.

Neuralgia of the arm.—The affection is known as cervico-brachial neuralgia. In it the neuralgia affects the sensory branches of the lower four cervical and the first dorsal nerves. The pain may be caused by (1) any injury in the arm or hand as by a pin or needle, or other pointed instrument. The injury affects the peripheral branches. 2. Pressure on the nerves from any foreign bodies as shots, &c. 3. Disease of the vertebræ leading to irritation of the nerves just at their point of exit from the spinal canal. 4. Swelled lymphatic glands in the axilla, or aneurism of the subclavian or the axillary arteries, giving rise to compression of the brachial plexus. 5. No perceptible cause can be ascertained, there may be a rheumatic diathesis present. 6. Over-use of hands and muscles of the arm as in writing, knitting, &c. 7. Persons subject to angina pectoris often suffer from neuralgia of the arm. The disease is characterised by severe lancinating pains, which often recur at very short intervals. The pain may be diffused over a large area, or limited to the axilla or upper part of the arm. It generally follows the distribution of the radial, ulnar, or musculo-cutaneous nerves. Besides the pain, there is often formication and numbness in the fingers, and disturbances of nutrition of the skin, giving rise to urticaria.

Intercostal neuralgia.—The disease is one of the most common forms of neuralgia. It is a morbid excitement of one or several intercostal (spinal) nerves. The nerves chiefly affected are the sixth, seventh, and eighth intercostal at their terminations, which are distributed over the sternum and the epigastrium.

Causes.—Diseases of the vertebræ pressing on the dorsal nerves as they pass through intervertebral foramina; carious ribs, swollen glands, also act by pressure upon the dorsal nerves. After recovery from pleurisy or pneumonia, persons very often complain of intercostal neuralgia. It is common among the hysterical with chronic uterine diseases. The peculiar liability of the sixth, seventh, and eighth nerve to the pain is supposed to be due to the dilatation of the venous plexus, which most readily occurs at those places. The disease is very obstinate. It often lasts for years. The pain is very severe and lancinating, and the patient cries out when touched. Sometimes it is diffused, at other times it occurs in certain *points douloureux* of Valleix. Besides the pain the part is also tender to the touch. Firm pressure often relieves the pain. The pain is constant, and increased on deep inspiration, coughing, or on movements. It is associated with nutritive changes, and herpes zoster is a common complication. Its course is very irregular; it often develops slowly and passes off gradually, after causing very prolonged suffering. In this affection three kinds are observed according to the *points* affected. 1. Posterior or vertebral, where the seat of pain is in a point just external to the spinous processes of the dorsal vertebræ, and on the level with the intercostal space. 2. Lateral point. It lies in the middle of the intercostal space where the nerve divides and passes towards the surface. 3. Anterior. It lies between the costal cartilages in the upper intercostal spaces, and is called the sternal, and in the lower intercostal spaces it is known as epigastric. At other points the peripheral ends of the intercostal nerves approach the skin. The skin in the neighbourhood of these points is sometimes so hyperæsthetic that contact with the clothes is almost unbearable.

Mastodynia.—It is a neuralgic complaint affecting intercostal nerves distributed to the mammary gland. It affects women more than men. Puberty is a most common period. The affected breast is extremely sensitive at one or several points. The pain is of a shooting or lancinating character, and extends to the shoulder upwards or to the hips below. The disease is persistent and lasts for a very long time. The breast is sometimes enlarged, and presents one or more nodulated swellings, which are exquisitely tender and painful. The symptoms may give rise to a suspicion of cancer, but there is no retraction of the nipple, and the pain and swelling subside under appropriate treatment. These affections generally occur in single women between twenty and forty years of age.

For an account of the treatment of these various forms of neuralgia, in order to avoid recapitulation, the reader is referred to the chapter on neuralgia in general.

SCIATICA—NEURALGIA ISCHIADICA.

Sciatica, otherwise called hip gout, is a very frequent form of neuralgia. The word literally means the hip. It is a neuralgic affection of the sensory filaments of the sciatic trunk which is made up of the fourth and fifth lumbar and first and second sacral nerves. It consists of paroxysmal pain at the point of exit of the great sciatic nerve, and extending along the course of it down the back of the leg and to the foot.

Causes.—It most frequently occurs in men over twenty years of age. Those of nervous temperament and of the gouty and rheumatic habit are most prone to the attack. Those whose occupations expose them to cold or damp form the largest contingent of sufferers. It is common among sailors, soldiers, and fishermen. The disease seldom affects both sides, and it is more frequently felt on the left side. It is often excited by the slightest cause when the predisposition is extreme. The affected skin is sometimes very sensitive, but there is neither swelling nor discolouration. Another main cause is pressure upon or along the sensory branches of the sacral plexus. The pressure may be from—1, caries of the vertebræ just at their intervertebral foramina; 2, some growth or foreign body in the pelvis; 3, swollen and indurated lymphatic glands (retroperitoneal); 4, accumulated fæces; 5, ovarian cysts; 6, child's head remaining long in the pelvis; 7, exudations, the result of metritis, in the subperitoneal tissue.

Symptoms.—In sciatica all the ramifications of the cutaneous nerves of the sacral and lumbar trunks are more or less affected. In neuralgia of the posterior cutaneous nerves of the thigh, the outer and posterior part of the thigh becomes painful. In neuralgia of the superficial branches of the peroneal nerve the pain is in the outer and anterior part of the leg, and in the dorsum of the foot. There is persistent deep acute pain in the hip between the great trochanter and the tuberosity of the ischium. The most painful spots are in three points in the thigh, others on the knee, one below the knee and on the outer side, and one above the outer ankle.

The affection begins with great severity and lasts for a long time. The pain shoots upwards and downwards in the course of the nerve. It is increased on movement, such as walking, pressure, and coughing, sneezing, and straining, and there is sometimes tenderness in the course of the nerve. Besides these constant pains there are often pains of a convulsive spasmodic character in the course of these nerves. The pain sometimes begins suddenly and without warning, and especially after going to bed. The tension of the fascia generally causes pain, so that the patient lies with his legs somewhat flexed. The thigh may be slightly bent on walking. The motor filaments often participate in the affection, and hence the muscles along the course of the nerve are often thrown into violent convulsive actions. During even a mild paroxysm the gait of the patient is somewhat peculiar and altered. He drags the foot instead of lifting it. Disturbances of nutrition are seldom found in this affection. The limb, however, becomes weak and flabby, and wastes from want of use. Occasionally the excitability of the nerve is greatly impaired, and this change may be followed by some degree of anæsthesia and partial paralysis. The disease is persistent, and lasts for years. It is liable to recurrences, and is difficult of cure. Sciatica is often associated with lumbago and with excess of uric acid in the system.

Treatment.—In sciatica all the remedies referred to in the treatment of neuralgias in general may be tried. If there be any symptoms of a syphilitic or rheumatic taint they must be treated by warm baths with mercury or iodide of potassium. The bowels should always be kept open; even drastic purgatives may be given. For general debility cod liver oil and iron are indicated. If there be any disease of the vertebræ, moxa, or the superficial cautery by means of the hot iron to the back may be used. In recent cases, local abstraction of blood, by wet cupping, or a few leeches, will sometimes suffice. In chronic cases some recommend derivatives to the skin, as flying blisters; first to the back over the sacral region; secondly, between the trochanter and the tuberosity of the ischium; thirdly, to the back of the thigh, and so down to the feet. In chronic cases, as a last resource, some recommend division of the affected nerve (neurotomy), others, acupuncture along the course of the nerve, others, removal of a portion of it; in other cases stretching of the nerve has been practised with advantage. Many recommend issues, and the actual or the galvanic cautery along the course of the nerve. Others again apply direct sedatives locally to the part, as belladonna, veratria, aconite, and opium. The natives of India use warmth and sedative vapour or sulphur baths to the part with benefit. Tinct. Actææ Racemosæ with iodide of potassium may be recommended for chronic cases. Daily hypodermic injections of morphia and atropia are often very valuable. Among other efficacious means may be named the continuous current of galvanic electricity, or faradization repeated from time to time. In urgent cases, in order to relieve the pain, inhalation of chloroform or ether may be had recourse to. In India, the actual cautery is found to be of immense service in many cases. Amongst the specific drugs turpentine in 20 minim doses given morning and evening is to be extolled. If there be a gouty taint, colchicum may be given in combination with alkalies, and the diet must be properly regulated. If there be a history of rheumatism salicylate of soda may be given every four hours in 20 grain doses. Lemon-juice in large doses, two ounces daily properly diluted, is useful in some chronic cases; and a course of warm bathing is also likely to prove beneficial.

Convulsive Nervous Diseases.

These are functional morbid conditions, and belong to a class included under the term "neurosis."

This class includes individual affections, each characterised by spasms or convulsions. They embrace the following: epilepsy, hysteria, chorea, tetanus, and rabies; they also include local spasms occurring in different localities.

In the chapter on paralysis we have already treated of tremulousness of muscles arising during voluntary efforts. We have also remarked that in paralysis the muscles become rigid and contracted. In this part we have to describe various convulsive movements which may arise without paralysis. Convulsions may affect a single muscle, a group of muscles, a whole limb, or the one half of the body, or the whole body. They may be slight or very severe; may be paroxysmal, or may be attended with exacerbations.

When intermittent, the convulsions are known as clonic contractions; the continuous ones are called tonic spasms. The slight forms are known as tremulousness, which generally ceases during sleep and appears only when an effort is made to move the muscles; it depends on the transmission of voluntary impulse.

The convulsive movements attendant on epilepsy are of a clonic character. Similar clonic contractions in affections other than epilepsy are known as epileptiform convulsions; and these occurring in children are known by the term eclampsia (infantum). During the puerperal state, and as a complication of uræmia, epileptiform convulsions are of very serious import.

The tonic spasms occur where the contractions are continuous, as best seen in the calves of the leg after fatigue, in contraction of the muscles of the calf of the leg in cholera, in contraction of muscles in paralysis, in tetanus, and in strychnia poisoning.

Convulsions sometimes occur in young girls who are suffering from hysteria. These are characterised as being not purely automatic, nor involuntary. They are excited by the will acting in an irregular manner.

Local spasms or spasmodic diseases.—Under this heading various local manifestations of spasm occur. Thus we meet with spasm of the glottis and of the œsophagus. Intestinal colic, laryngismus stridulus, and asthma are also varieties of local spasm. These are treated *in extenso* in other sections.

Local spasms involve particular peripheral nerves. That affecting the region of the facial nerve gives rise to tic convulsif, otherwise known as mimic spasm of the face. Spasm also occurs in the region of the spinal accessory nerve of Willis. When seen in children it is known as nodding spasm, or salaam convulsions. Where the spasm is confined to the sterno-cleido-mastoideus muscle, it is known as torticollis.

Spasm or morbid excitement of the motor nerves, which supply the muscles of the fingers, is known as writer's cramp, cobbler's spasm, &c.

Spasm signifies morbid excitement of the various motor nerves, just as excitement of the nerves of sensation is evidenced by a feeling of pain and other reflex symptoms; this excitement is known by contraction of the muscle which it supplies.

Tic Convulsif,

Otherwise known as mimic spasm of the face. It is due to morbid excitability of those portions of the facial nerve which supply the muscles of the face, except the digastric and the stylohyoid muscles. It occurs in connection with neuralgic pain, and is called mimic from the grimaces and contortions which it occasions.

Pathology.—Some regard tic convulsif as a neurosis, and believe it to arise from irritation in distant organs, as the rectum by worms, or the uterus. Others attribute it to morbid excitement, due to the influence of noxious agents upon the face, as exposure of the nerve to cold; or to other local causes, as diseased teeth or gums. The pressure of a tumour upon the filaments of the trigeminus, leading to irritation of the facial by a sort of reflex action, gives rise to mimic spasms. The condition is more common among men than in women, and when present may be aggravated by mental excitement or by voluntary exertion.

Symptoms.—The spasm generally involves one side of the face; bilateral spasms are extremely rare. In some cases the spasms are tonic; in others, clonic. The disease is characterised by a sudden setting in and sudden disapearance of various contortions and grimaces of the facial muscles. There is elevation and depression of the occipito-frontalis muscle, corrugation of the eyebrows, dilatation of the alæ nasi, and twisting of the angle of the mouth. The paroxysms appear and disappear in an instant, or after several minutes, and often recur at short intevals. The contortion is often mistaken for distortion due to hemiplegia. In the former there is unimpaired muscular power, and the muscles act freely under the induced current.

In hemiplegia, the muscles of the unaffected side of the face are free from any trace of contraction, and by drawing the skin of the healthy side the mouth may be brought into proper position.

Treatment.—As tic convulsif is often due to diseases of the teeth, jaws, or gums, they should be inquired into and treated. Another chief indication consists in checking the paroxysm and preventing further recurrence. Relief and even removal of the spasm may often be obtained by making pressure upon the facial nerve or upon the filaments of the trigeminus. Where the accompanying pain is very great, hypodermic injection of morphia oftentimes gives relief. Faradization and the continuous galvanic current of electricity have both been useful in chronic cases. Where the disease is due to general debility, tonic doses of quinine, iron, strychnia, and even zinc and arsenic, may be prescribed with advantage.

SALAAM CONVULSIONS,

Otherwise known as nodding spasm. It is a spasmodic affection involving the muscles supplied by the spinal accessory nerve of Willis. The spasm is bilateral, either of a tonic or clonic character, and involving the trapezius and the sterno-cleido-mastoideus muscles.

Causes.—Some attribute the disease to violent twisting of the neck, to exposure to cold, or to some disease of the cervical vertebræ.

Eclampsia nutans is the term applied to this affection, as it occurs in children. In them it is generally of strumous origin, and occurs at the period of dentition. From its course it is supposed to be a symptom of cerebral disease. It is a bilateral clonic spasm, subject to recurrences, and occurring as many as twenty to thirty times in a minute. The movements cease during sleep and when the head is supported. The mind is often permanently affected, and the patient ultimately becomes epileptic or idiotic.

The disease affects both sexes alike, and is sometimes seen in adults. At the outset there is pain and uneasiness for a time, and then constant jerking of the head follows. As the disease progresses the spasmodic contractions become more developed and more violent, and the head is habitually carried on one side. With each paroxysm the head is drawn obliquely downwards and forwards or backwards, according as the trapezius or the sterno-cleido-mastoideus is affected. The spasm sometimes extends from the head to the muscles of the face, to those of mastication and of the shoulder and arm.

If the irritation extends to the facial muscles the face becomes deformed and twisted. In children, the salaam convulsions are characterised by periodic recurrences of clonic spasms of both sterno-cleido-mastoids, and the child nods its head incessantly.

Torticollis is a condition in which the head is drawn forward and downwards, and the neck is twisted in a rotatory manner. The spasm chiefly affects the sterno-cleido-mastoideus muscle. It is tonic in character, but often preceded by clonic convulsions. In the beginning there is pain in the neck resembling rheumatism or stiff neck; gradually the pain is increased, and the stiffness, chiefly of the sternal portion of the muscle, becomes more marked. The muscle feels like a hard cord, and the skin of the neck is stretched. The head is drawn more and more to one side, and the skin at the upper and back part of the neck is thrown into transverse folds.

In long-continued cases the obliquity of the neck often leads to curvature of the spine and to sinking of the thorax on the diseased side. In the affected muscles the electric contractility and irritability are increased.

Treatment.—Faradization and galvanism are said to be the most reliable remedies; they are applied to each one of the affected muscles. As a rule, the results are not very satisfactory. Issues or setons to the back of the neck, and the internal use of oxide of zinc or of some preparations of iron, have effected a cure in some cases. The actual cautery, lightly drawn over the skin of the affected part, has produced good results in obstinate cases. Division of the muscles has been tried as a surgical remedy.

SCRIVENER'S CRAMP.

The term denotes morbid irritability of the motor nerves which supply the muscles of the fingers. There is a spasmodic contraction of the muscles they supply.

In this disorder a single muscle, or part of a muscle, or a set of muscles, when habitually and frequently exercised for certain actions, become the seat of tremors. The disease occurs only when the specific or accustomed actions are performed. Under all other conditions the affected muscles apparently act well and seem healthy. There is a partial loss of controlling power.

Causes.—The disease affects penmen, clerks, musicians, compositors, sempstresses, and shoemakers. It seldom or never attacks persons under thirty years of age, or those whose occupation is of an easy character. The derangement is due to long-continued exercise of the affected muscles and their consequent fatigue.

Similar phenomena of spasmodic contractions of muscles may be found in any part of the body. Thus, a tailor, a fencing-master, or a turner, may become so affected as to exhibit spasm of the muscles which they habitually call into play.

Pathology.—The disease is a reflex neurosis. It is due to over-exertion of the implicated muscles, which are tired out from fatigue or extreme weakness. Their electric irritability is diminished. The exact nature and the seat of the disease are not known. It may be that some change in the nerve-centres precedes the local manifestations.

Symptoms.—The patient complains of fatigue and pain in the hand and forearm shortly after he has begun to write. The pain is especially felt in the thumb, but very often spreads to the muscles of the upper extremity. There is also a sense of insecurity in grasping the pen. At first the fatigue or pain disappears after a night's rest. As the case progresses there is more unsteadiness of movement, and the patient while writing is obliged to rest for a time, or to give more attention to the movement of his hand. He feels an uncomfortable burning sensation in the hand or forearm, with more or less aching. The muscles of the first three fingers become painful and weak. The thumb gradually becomes convulsively flexed, while the middle and index fingers are rigidly contracted. The writing therefore becomes more illegible and jerky, although, curiously enough, the patient can generally employ his hand quite steadily for other purposes.

The symptoms grow worse immediately the attention is drawn to them, or any attempt made at writing. Even the fear of their arising sets up spasm. Pain is usually not very marked; a dull aching is all that is complained of.

The disease is extremely tedious and obstinate. Recovery is rare. The affection of the muscles is sometimes paralytic, but in most cases spasmodic. Different muscles are affected in different cases. Occasionally the muscles of the hand and of the forearm are all involved. The paralysis is never absolute, and the sensation is not at all affected.

Treatment.—It is for the most part unsuccessful. It consists of absolute and prolonged rest from writing; of exposure to sea air with sea bathing, and abundant nourishing diet. The continuous galvanic current applied to the muscles of the thumb and index finger and along the spine is serviceable. The strength of the current should be moderate. Stimulating liniments and douches may also be employed. Blisters or iodine liniment may be applied, if there be any tenderness along the course of the nerve-trunks. The patient should always use a goose-quill instead of a steel pen.

CHOREA—ST. VITUS' DANCE.

Definition.—The term signifies dancing or jumping. The complaint is a purely motor or convulsive disorder of early life, and is characterised by morbid restlessness, and a variety and combination of irregular, violent, and ludicrous actions or movements of the voluntary muscles of the face, head, shoulders, and limbs, with or without any control of the will. The voluntary movements are interfered with by the superaddition of involuntary movements. The movements rapidly recur, and consist, according to circumstances, of alternate flexion, extension, abduction, adduction, pronation, and supination. These movements cease during sleep. They are usually unilateral at first, but soon become general, and sometimes subside in a few weeks. Owing to the manifold and grotesque involuntary jerking movements the complaint is also called insanity of muscles. There is no derangement of the sensory or intellectual functions. When the disease occurs at an advanced period of life it is very intractable.

Causes—predisposing.—It is common among boys and girls generally between ten and fifteen years of age. Children of nervous, hysterical parents suffer more than others, and some cases are traceable to fright or emotional excitement of a depressing nature, operating on a nervous and feeble constitution. It is most common at the time of the second dentition and at puberty. Females suffer more often than males. The complaint is often hereditary. Previous attacks, chlorosis, bad living, and unfavorable hygienic conditions favour its production. A recent attack of acute or chronic rheumatism in children, and a cardiac disorder, evinced by mere irregular action, or anæmic murmur at the base, or a distinct organic systolic murmur at the apex of the heart, rheumatic endocarditis, and pericarditis, or an embolus in some part of the cerebral circulation often precede, or coexist with or follow chorea. *Exciting causes.*—Fright, or blows, or falls, by which the stability of the nervous system is disturbed. Reflex irritation of worms, onanism, or carious teeth may cause it. Choreic children should be kept separate from others of weak nerves, as the disorder may be acquired by imitation.

Pathology—is quite obscure. Some regard it as due to perverted functions of the cerebrospinal motor nerves, and the choreic movements are likewise referred to the impaired nutrition of the large ganglia of the brain, namely, the corpus striatum and the optic thalamus. The unilateral commencement of the disease may point to a lesion in the crus cerebri, the corpus striatum, the optic thalamus, or the cerebral hemispheres. But it is a fact that in any lesion of one or other of these centres, the cerebral functions are also disturbed and vasomotor paresis results, but the muscles of the eyeballs and those supplied by the facial nerves escape. In chorea these phenomena are wanting, and the muscles supplied by the facial nerve are chiefly involved. Another point in the pathology is that in chorea the disease soon extends to the opposite side of the body, and does not affect deglutition and respiration, which could not be the case if chorea were due to cerebral lesions. Sometimes chorea occurs in connection with embolism of the cerebral arteries supplying the corpus striatum, optic thalamus, and the convolutions; and it has been thought that these nerve structures being ill nourished undue muscular excitement may possibly result.

The convulsive movements in chorea have a close resemblance to locomotor ataxy, and might thus as well point to some lesion of the posterior columns of the cord. This supposition is also incorrect, for in diseases of the cord there is no unilateral paralysis, though the impairment of motion may be mainly noticed on one side, while that of sensation occurs on the other. In chorea the impairment of motion is the only change in the affected regions. The cessation in the jerking movements which occurs during sleep, shows that fever, and the spasms may prevent sleep, and lead to exhaustion. In simple forms the movements are limited to the face and limbs and after continuing for months end in recovery. In rare cases the disease becomes permanent and ends in imbecility. Where the spasms are incessant and very forcible, the extent of the muscular system affected is very great, the patient has no sleep for several nights, he grows anæmic, both from wánt of sleep and from exhaustion due to the violence of the movements; the spasms also prevent the efforts at swallowing. The patient becomes exhausted, both bodily and mentally, and dies from collapse or coma. In such cases the evacuations escape involuntarily; owing to constant movements, bedsores rapidly form over the elbows, hips, and sacrum. Death is preceded by delirium, or may be due to erysipelas, or to heart disease or to complications. Such cases are, however, very rare. When the disease supervenes upon acute rheumatism, it is to be regarded as very serious.

Diagnosis.—It may be mistaken for (1) locomotor ataxia, (2) paralysis agitans, (3) multiple sclerosis, (4) epileptic or hysterical attacks. In all these there are varieties of jerking movements or tremors. In locomotor ataxia the diagnostic features are marked and clear. The movements in chorea are either wholly involuntary or superadded to those excited by the will. In ataxia the movements are altogether voluntary but inco-ordinate; chorea-movements are spasmodic. In ataxia spasms never occur. In paralysis agitans and in multiple sclerosis the movements are rhythmical. In ataxia there is absence of regularity or rhythm. In epilepsy or hysteria, the jerking movements or contractions are simple and monotonous. In chorea there is a degree of variety and a combination of movements, various groups of muscles being affected.

Treatment.—The disease often gets well spontaneously in a few weeks, and generally subsides within three months. The plans recommended involve the getting rid of any obvious cause of reflex disturbance such as worms, &c. In this case, if the worms are removed by appropriate remedies, the disease is cured. If there is any history of self-abuse, the practice must be checked. Excess of any kind should be avoided. The secretions and the state of the digestive system must be attended to, and the condition of the system generally should be improved by attention to hygienic laws. Thus tonics, as cod liver oil, the hypophosphites, antispasmodics, and purgatives are highly beneficial. Cold douches to the body and hot water to the feet also do good. Salt-water bathing, exposure to bracing air, and gymnastic exercises may be recommended. A child suffering from chorea should be separated from other children, both for its own sake and theirs. The disease is sometimes contracted through imitation. Arsenic in any form generally acts very satisfactorily. In obstinate cases, without any complication its effects are often decidedly curative. Under its use, the severity of the attack is lessened, and the duration also diminished. Large doses are often necessary. It may be given at first in five or ten minim doses three or four times a day. If anæmia exist, the arsenic may be combined with iron. When used hypodermically it does not derange the stomach. If there is a history of rheumatism, actæa racemosa is often useful. Calabar bean has been recommended, either in the form of powders or tincture, where the movements are so violent as to cause exhaustion and continued sleeplessness. The hypodermic injection of morphia has been tried with benefit, and the hydrate of chloral may be given. Opium with antimony, and chloroform-inhalations are of great service for the relief of the movements. Ice-bags to the spine have been tried with benefit. They should not be used if rheumatism and fever and pain in the joints exist. General faradization and the constant galvanic current have been used in some cases, but the experiment requires further trial. Some physicians recommend sulphate of zinc, and it is often very useful. When given in large doses every two hours its effects are sometimes marvellous. It acts by promoting the nutrition of the nervous system. Conium has been given in large doses. It controls the movements, but the relief is temporary. The bromide and iodide of potassium, and various vegetable drugs, as turpentine, belladonna, and other narcotics, have proved to be of little avail in practice. If there be pain on pressure in the cervical region in the back, counter-irritation by means of mustard plasters or mustard liniment has been recommended. The patients must be directed to resist the movements by strong efforts of the will. Phosphorus and strychnia combined may be given as nerve nutrients and nerve tonics. In most cases of chorea good nutritious diet is highly useful; indeed, in some patients it is all that is required. Its good effects are especially seen in hospitals.

In those severe cases of chorea in which the convulsions are very violent, much relief and comfort may be obtained by restraining the movements. For this purpose the legs should be bandaged with flannel and fastened together; the arms should also be fastened to the sides, and a blanket, or broad bandage, passed across the abdomen and hips. The patient, thus restrained, often falls asleep and is much relieved thereby. Plenty of good nutritious food, in a liquid form, should be given at the same time, and stimulants are generally indicated.

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EPILEPSY.

Epilepsy is a functional disorder of the motor nerve-centres, chiefly affecting the medulla and brain substance at the base of the skull. The term literally means a falling sickness. It is a paroxysmal convulsive attack, of short duration, characterised by sudden and temporary loss of sensation and consciousness and voluntary motor power, and by clonic spasms of the voluntary muscles and tonic convulsions. The paroxysm is followed by profound sleep. The two main conditions are unconsciousness and convulsions.

Causes.—These are various; the most potent are psychical derangements, such as sudden fright; overwork of body or mind in persons whose brain is weak; excitement and anxiety. The disease is often hereditary, and about 35 per cent. afford evidence of inherited neurotic tendencies. Of cases of this character the disease is most common among females, and is most often met with in families where the members are insane or intemperate or hysterical. In such families it is common to find one epileptic, another insane, a third suffering from chorea, the fourth an idiot, and the like. The predisposition for epilepsy is found in those who have, during their infancy, suffered from convulsions due to reflex causes. The disease attacks males and females in the proportion of five to six, and occurs most frequently between the ages of ten and twenty. More than 25 per cent. of cases occur under ten years of age, and between ten and twenty about one third of the total number.

All the assigned causes just enumerated are not enough in themselves to produce epilepsy. There is always the co-operation of some unknown factor. It is a very common disease, one in a thousand suffering from it. Cachectic persons and drunkards are more subject to it than the healthy. The sight of a person in an epileptic fit sometimes produces epilepsy in persons who are hysterical or weakminded. Changes in the structure of the brain tend to it. Among these may be mentioned (1) imperfect development of the skull; (2) thickening of the bones of the skull, (3) thickening or adhesions of the membranes of the brain, (4) morbid growths pressing upon the brain, and (5) increased size of the brain. Epilepsy may also be due to abnormal irritability of the brain and of the sensory nerves at their peripheral ends. These irritations are generally reflex, and may originate in the organs of digestion, the generative organs, &c. Worms in the intestines very often cause a fit.

Other exciting causes of epilepsy are blows and falls on the head. In these cases the patient is perhaps stunned for a time, and this condition is soon followed by intense emotional disturbance. Other causes are: acute diseases, as scarlet fever, measles, typhoid and other low fevers. In these affections some poison in the blood, as uræmia in scarlet fever, affects the nervous system; another toxæmic influence is chronic alcoholism. Chronic lead poisoning and excesses in tobacco smoking are frequent causes of the attacks. In females, retarded or absent menstruation is a cause of the disease.

Pathology.—It is quite obscure. Some believe epilepsy to be a functional disorder of the brain, and that when organic derangements are present they are rather the effects of repeated fits than the cause. In opening the skull we frequently find the pia mater more or less congested; there is sometimes disease of the blood-vessels and softening or induration of the brain substance. In epilepsy the brain is successively anæmic and congested.

The extreme pallor of the face at the commencement of the attack points to anæmia of the brain, and great turgescence soon replaces the pallor. According to another theory the vaso-motor nerves of the medulla, owing to disease, become disturbed in their functions; an afflux of blood (as in hooping-cough, or when a morbid poison accumulates in the blood) acts upon the medulla oblongata, and excites convulsions.

The influence of fright in causing epilepsy is easily explained. Terror or fright stimulates the motor centres, and the effect shows itself in sudden muscular actions or starts. In such cases the tremor often persists. The organic (the vaso-motor) nerve-centre is first stimulated and then depressed, and the sphincters lose their power; the sweat-nerves are excited, and the heart's action increased in frequency. The muscular spasm is due to the sudden and violent action of nerve-cells or the discharge of nerve-force of the grey matter, which stimulates the nerve-fibres of the muscles.

The aura, or the sensation which the patient sometimes feels before losing consciousness, is due to the commencement of the discharge of nerve-force. This sensation is often described as resembling that due to the passage of cold air or light vapour from the trunk or extremities to the head; but the meaning of the term has been extended to include any phenomenon, whether sensory or motor, which ushers in an attack. The convulsions which occur when the cortex is irritated depend on the discharge of motor centres, which include the deeper structures, as the corpus striatum, the cerebellum, and other parts at the base of the brain.

In the pneumogastric aura the seat of discharge is in the medulla. In it the aura consists of a peculiar sensation, rising from the epigastrium to the throat, of choking dyspnœa, and palpitation. The respiratory centres being in close proximity, we find disturbance of the respiratory functions before convulsions set in, with loss of consciousness. The motor discharges will not account for the loss of consciousness ; but any small lesion of the brain, in any part, may cause it for a time. The discharge which causes convulsions also influences the peripheral vaso-motor nerves, and leads to pallor of the face. Pallor may also be due to cerebral action, as proved by the effect of emotion. Another theory which explains this morbid process (pallor) is that of vaso-motor spasm. It is said that the discharge is due to vaso-motor spasm affecting particular arteries, and causing local cerebral anæmia. This cerebral anæmia leads to pallor of the face, to loss of consciousness, and to general convulsions. As there is tonic contraction of the arteries we find tonic spasm in the initial stage. The clonic spasms are due to irritation of the medulla by the venous blood. This stage resembles the state of cyanosis due to interference with respiration.

Some pathologists regard the grey matter in the medulla oblongata and upper part of the cord as the seat of primary discharge in epilepsy. Others include the corpus striatum, the cerebellum, and other parts at the base of the brain. Some eminent physiologists have proved by experiment that division of the lateral columns of the cord between the medulla and the tenth dorsal vertebra produces epileptic convulsions. It must be admitted that these convulsions are of spinal origin, and that the motor tract of the cord is chiefly involved. The implication of nerves at the base of the brain shows that motor nuclei are in the medulla oblongata and in the floor of the fourth ventricle. The unilateral tendency of spasms in epilepsy points to the corpus striatum as the centre of motion. When we bear in mind that in epilepsy, convulsions are the most prominent symptoms, and that they are preceded by some aura, some sensation, some spasm, some hallucination, and are from the first attended with loss of consciousness or with total insensibility to surrounding impressions, it must be acknowledged that these phenomena must be due to some derangement of a limited spot of cerebral origin, or to the disorder of some portion of the grey matter of the encephalon which is concerned in sensori-motor processes.

The symptoms show conclusively that there is a state of undue excitability of the medulla oblongata, in consequence of which consciousness and motor power are deprived paroxysmally of their controlling force. As there is contraction of the arteries, we have convulsions ; the contractions are then followed by paralysis of the arteries, and we have the corresponding stage of exhaustion and prostration, and the fit ends. The circulation is now gradually re-established, and the patient recovers from the fit. The after symptoms are due to carbonic acid poisoning.

Symptoms.—These are—1, premonitory; 2, those during the fit; 3, those succeeding the fit. The premonitory symptoms vary in duration from a few seconds to many minutes or even hours. The paroxysm or the fit (unconsciousness and convulsions) sets in, in a majority of cases, without any warning, either proximate or remote. In a few cases premonitory symptoms occur, and are of a varied and often unreliable character. In some persons the fit is regularly ushered in by the warning known as the aura. This, as above mentioned, is an indescribable sensation of an inward working or peculiar disturbance. This sensation is compared by some patients to that caused by a stream of cold water, or a current of cold or warm air, or to the creeping of an insect. It emanates from some part of the body and ascends towards the brain. The aura is understood to be an impression made upon the consciousness by some commencing action in the brain or by the effect of this on the periphery. It is always a purely subjective sensation. Instead of altered sensation the attack occasionally begins with some alteration in motion. This is known as motor aura, and is evinced by jerking or twitching of a limb, or of certain muscles. In some cases again, the fit is ushered in by other abnormal phenomena referable to the brain. These are: dulness and incapacity to do any mental work; hallucination of the senses; spectral illusions; confusion of thought or speech. The patient sees imaginary objects or complains of noises in the ears or suffers from headache, giddiness, or dimness of vision. These symptoms constitute mental aura. Directly the sensation commences the observer would notice some pallor of the face, the patient utters a sudden piercing cry, and then the fit commences. During the fit the patient falls to the ground, usually on the back or sides, and he frequently injures himself. In many cases the consciousness is lost early, and the commencement of the fit is not felt.

Symptoms during the fit.—The patient, after uttering a single loud piercing shriek, suddenly falls to the ground senseless. The face assumes a deadly pallor, but soon becomes livid and turgid.

The patient soon exhibits violent tonic or convulsive movements. There is extension of the limbs and body; the head is turned backwards or over to one or other shoulder, and the arm describes a rotatory movement. The glottis is spasmodically closed, and the thorax is fixed. There is also rigidity of the muscles of the face and neck, attended with fibrillar movements of the muscles of the limbs and body, especially of one side. The eye-balls roll, the lips are distorted, and the whole features become hideous, the pupils are dilated and fixed. The disease is called "falling sickness" because when the patient suddenly loses consciousness, he is apt to fall anywhere, and sometimes injures himself in a serious manner. In a few seconds the spasms become clonic; they are often so violent that the neck is twisted; the teeth are clenched, and deep congestion and cyanosis follow. Respiration is interrupted and the jugulars throb. The countenance, which was fixed and unmovable, is now convulsed. There is twitching of the forehead and eyebrows, and occasional biting of the tongue; foam collects round the mouth, which is firmly closed; the eyeballs are turned up and insensible to light; the eyes are partly open; the hands are tightly clenched; the wrists, and the metacarpo-phalangeal joints of the fingers, are firmly flexed.

The stage lasts for from thirty seconds to two or three minutes, during which, owing to violent muscular exertion, the skin is cold and clammy, the pulse small, feeble, and quick, the chest is fixed, the respiration difficult and often suspended for many seconds. After the fit these violent motor symptoms or convulsions cease, lividity disappears, but the patient is insensible; or there is a gradual return of sensibility, the patient looks round, and tries to speak. The heart beats violently, and the skin is bathed in perspiration. The patient, though unconscious of what has occurred, now takes a deep sigh, and appears as if in a sound sleep, and from which he awakes exhausted, and continues dull and stupid for some hours. In many cases he remains comatose for some time. Deep sighing inspiration, diarrhœa, or vomiting, and in some cases copious secretion of limpid urine, containing excess of urea, urates, and phosphates, often end the attack.

During the interval the respiration becomes quiet, the pupils are now contracted but insensible to light, cyanosis disappears. The patient now feels exhausted, is mentally confused, and complains of headache. The muscles are relaxed, and the patient feels weak for some days; very often he awakes with red eyes, a sore and bleeding tongue, headache, dilated pupils, and a stupid expression of face, symptoms often succeeded by other fits.

General course.—Pure epilepsy generally runs a chronic course, and the fits occur in more or less frequent succession. Where the course is very acute, the fit occurs but once or at most twice. A fit occurring during the puerperal state, or as a result of dentition, is known as eclampsia. The intervals between the fits vary considerably in different individuals. In some they recur at long intervals, in others, one or more fits occur daily. In some cases the recurrences are periodical, and occur at regular hours during the day or night. In the case of women they most often recur at the menstrual periods. In some patients the recurrence of the paroxysm occurs after a lapse of days, weeks, or even months. Very often, when a fit recurs after a very long interval, it is followed by a series of attacks within a comparatively brief period. In some persons the attacks are more frequent during the day. When the disease is obstinate, and the fits are frequently repeated, they often come on only in the night, at the moment of going to bed, or at the time of awakening. The fits are often complete, but in many cases the paroxysms are incomplete and only a few of the symptoms are present. In the course of time, with recurring paroxysms, other symptoms are superadded and the attack finally becomes complete.

The attacks are sometimes followed by temporary derangement of the mind. Such patients often become low-spirited, easily excited, or weak-minded. In inveterate cases the result may be a permanent condition of melancholia or insanity. The patient is liable to outbreaks of passion, and in some cases he becomes imbecile or idiotic. Epileptics are often weak-minded, their memory is dull; they often indulge in lasciviousness and gluttony; they avoid society, and are extremely troublesome to their friends and attendants. In long-standing cases the personal appearance changes; the features become coarse, the lips thick, the face bloated, and the body clumsy.

Prognosis.—A patient rarely dies during a fit; although during the paroxysm there is suspended respiration, coma, or convulsions. Epileptics are not long-lived; they seldom recover completely from their disease. They are apt to die from some cerebral affection, or some intercurrent, acute, or chronic disease, or from injuries during a sudden fall. Thus they may burn themselves by falling into fire, or may be drowned while bathing or by falling into a well, or be choked while eating.

Unfavorable cases—are those where (1) there is history of heredity; (2) where there is decided indication of some cerebral mischief; (3) when the fits are severe, of long duration, and occur at very short intervals; (4) when the consequences are cerebral derangements and disturbed innervation. The favorable cases are those in which the fits are (1) incomplete, (2) of short duration, (3) occur at long intervals, and (4) where there are changes for the better in the physical and psychical conditions.

Females are generally free from it during child-bed, and also during pregnancy. Intermissions are also observed during the course of acute fevers, and some intermittent maladies. The attacks often cease altogether with the cessation of the menses and as a result of sudden fright or other impressions on the nervous system.

There are various kinds of epileptic attacks. When the disease is fully developed, and the fit is severe and lasts for a long time, it is known as epilepsia gravior, or as the French term it, "le grand" or "le haut mal." When slight and lasting for a few moments it is called epilepsia mitior or "le petit mal." It is also called epileptic vertigo. In mild cases the cry and tonic spasms are sometimes wanting; there is only a momentary loss of consciousness preceded by vertigo. The patient, it may be, stops in the middle of conversation or business, is unconscious for a few seconds, and then resumes his talk or work where he left off and is quite unconscious of the fit. In some cases loss of consciousness is accompanied by twitching or lateral movements of the muscles of the face, and of mastication, dilatation of the pupils, but no initial pallor of the countenance; and after one or two deep sighing inspirations the patient feels well. In such cases the patient does not stagger or fall. In other cases again, instead of momentary unconsciousness, the patient does not fall but his eyes stare, he falters in his speech, and there is only a feeling of sudden vertigo, and the patient soon clings to some near object, or runs a short distance, or jumps violently, and in a few seconds recovers himself, after which there is no recollection of what has passed. In another form there is momentary delirium, as evinced by sudden laughter, incoherent language, or even violent mania which may sometimes take the place of coma. These and similar epileptoid fits often occur in patients who are confirmed epileptics, chiefly during the intervals between the severe paroxysms.

Epileptic patients seldom enjoy perfect health; they generally suffer from derangement of the brain, as shown by headache, giddiness, confusion of mind; in other cases their digestion is impaired. They may suffer from mania, which is always of short duration. Sometimes the nervous excitement is followed by exhaustion and partial paralysis, or curious movements of the muscles of the body. Some patients suffer from aphasia; others become asthmatic. The face is peculiar; there is often pallor of the countenance, and a strange staring appearance of the eyes.

The frequency of the convulsions varies according to the time at which they occur. They take place at night in one-fifth, and by day in more than two-fifths of the cases. In women the fits may either cease or chiefly manifest themselves during menstruation. In females with irregular menstruation the paroxysms often occur during the period.

There are other varieties of epilepsy besides those due to differences in the severity of the attacks. The most frequent is that which resembles hysteria attended with opisthotonos.

Characteristic points of diagnosis.—1. Sudden occurrence in one previously healthy. 2. A peculiar cry at the onset of the fits. 3. Complete loss of consciousness. 4. Convulsions, tonic at first, followed by clonic spasms. 5. Distortion of the face. 6. Biting of the tongue. 7. Foaming, with or without blood at the mouth. 8. Short duration of the fit. 9. Repeated occurrences.

Epileptoid and epileptiform fits.—These differ from epilepsy in the degree of their severity, and hence the distinction is only one of degree. The *epileptiform convulsions* may be very severe, and are symptomatic of diseases of very grave import. *Epileptoid fits* are convulsions similar in kind to those in epilepsy, but they are mild or imperfect manifestations of the disease. Usually there are no decided convulsions, but only a few twitchings.

Diagnosis.—When the fits occur at night time the diagnosis is a matter of extreme difficulty, but a patient who is subject to epilepsy may awake in the morning with a sense of fatigue or uneasiness, or with confusion of mind without obvious cause, or the tongue may be sore, or there is blood on the lips or upon his bedclothes, or he has passed urine or fæces in bed, or has hurt himself. Under these circumstances the occurrence of an attack during the night may be safely assumed. The diagnosis is also difficult where the duration of the fit is short and the premonitory symptoms absent.

Epileptiform convulsions are also sometimes manifested in various other disorders, as in the puerperal state, alcoholism, in children during dentition, disordered digestion (worms) at the commencement of fevers, and various inflammatory diseases. They also occur in cases of syphilitic and other cerebral affections. In all these affections the characteristic symptoms of epilepsy are generally wanting. Epilepsy is sometimes feigned; foaming at the mouth may be imitated by some mucilaginous substance, or by keeping a piece of soap in the mouth. In such feigned cases the mode of falling will at once disclose the imposition. In real epilepsy the patient often hurts himself; not so in feigned cases, in which the impostor manages to fall without doing himself any injury. Epilepsy may often be confounded with hysteria.

The following are the principal differences:

1. *Cause.*—Hysteria often occurs after painful emotions, after maltreatment of children by parents, or of wives by husbands, from terror at seeing disgusting objects, or witnessing a fit. Epilepsy occurs without any cause.

2. *Starting-point or premonitory symptoms.*—The starting-point in hysteria is the epigastrium. In hysteria the patient has warning, and she screams, but can be roused by a loud voice, or by dashing cold water, and the patient is much more noisy. In epilepsy,

the fit occurs without warning, or with an aura starting from the limbs, and there is a single cry or none at all.

3. *Symptoms during the fit.*—In hysteria there is want of utter loss of consciousness, and it is preceded by globus and a feeling of suffocation. In epilepsy there is coma, and the attack is sudden.

4. *Injury.*—In hysteria the fit occurs while the patient has opportunity and time to find a suitable place upon which to fall. In epilepsy he is often alone, and falls down as if struck by lightning, and hurts himself.

5. *Convulsions.*—In hysteria convulsions are rarely tonic and rarely unilateral, the patient throws the arms about, and the movements last at least fifteen minutes, or even longer; they are general and extensive. In epilepsy they are a sort of tetanus, and scarcely last more than two to five minutes, and are unilateral at first; after a time they become clonic.

6. *End of the fit.*—In hysteria, at the end of the attack, the patient cries or sobs. In epilepsy he looks dull and stupid.

7. *Face—tongue—pupils.*—In hysteria the face is not distorted. In epilepsy the face is much and hideously distorted. In hysteria there is no biting of the tongue; the eyelids are closed, and resist when raised; they are tremulous, and the pupils respond to light. Not so in epilepsy. In epilepsy there is dilatation of the pupils, even upon exposing them to bright light. In epilepsy, at the end of the attack, the patient falls into a deep coma, or recovers consciousness at once, and feels shaken and exhausted. In hysteria, after the attack, urine is passed in abundance, is pale, inodorous, and tasteless, and of sp. gr. 1000; the large quantity is owing to the spasm of the capillaries of the skin throwing additional work on the kidneys. In epilepsy no such thing occurs. In hysteria respiration never ceases, but is noisy and irregular. The skin is hot and perspiring. There is no lividity of the face. In epilepsy the respirations often cease, and there is lividity of the face. In hysteria the patient does not discharge urine and fæces without control. Quite the opposite in epilepsy. Hysteria never leads to impairment of intellect or to dementia, as is the case with epilepsy. In hysteria the temperature rises only a degree or less. In epilepsy it often rises to 103° or 104°.

From ordinary syphilitic epilepsy.—In syphilitic epilepsy the pain becomes worse at night, and there is sometimes, but not always, the presence of nodes. In the interval of the fits the patient complains of headache, giddiness, faintness, with irritability of temper. There is also a history of syphilis.

From apoplexy.—The epileptic seizure may be mistaken for the coma of apoplexy. In both there is a sudden fall, with possible injury as its result. This fact at once serves to exclude cases of opium poisoning and of drunkenness; for in both the patient sinks to the ground in a safe and comfortable manner. The apoplectic patient is usually less violently convulsed than the epileptic, while after the convulsive period his coma is deeper. In epilepsy the pupils are equal or dilated; in apoplexy some difference can usually be detected between the two pupils. In apoplexy symptoms of hemiplegia may sometimes be found, as, for example, looseness of the muscles of the cheek of the affected side. In opium poisoning the pupils are very much contracted, and there is often a smell of opium in the breath, just as in drunkenness there is the smell of alcohol. . The epileptic patient cannot be aroused in the convulsive stage; the apoplectic may sometimes, but with great difficulty; while in drunkenness and opium poisoning, persevering inquiries are at last answered, unless profound coma has set in. Uræmic convulsions, as has already been mentioned in uræmia, exactly resemble those of epilepsy, except that in epilepsy there is preceding congestion of the face, which is absent in uræmia. In mania there are convulsions, but no aura, and the attacks do not occur momentarily, and there is no profound coma or lethargy following. Where fits are due to cerebral diseases, there are other cerebral symptoms to denote the cause.

Treatment.—As the disease is often transmitted by inheritance, intermarriages between near relations among whom epilepsy prevails should be avoided. An epileptic mother should not suckle her child. In inveterate cases, very little can be done for the perfect cure of this complaint. The frequency of the paroxysms and their severity are not compatible with good health and long life. The indications for treatment are the same as in other chronic diseases. The source of the mischief should be ascertained, and if possible removed. If the patient indulges in excess of venery, he should be advised to abstain from it; if there be abuse of alcohol, of tobacco, or undue exertion of body or mind, these causes should be attended to and avoided, as there is a decided tendency for the paroxysms to increase in frequency if not properly attended to; attempts should be made to ward off the attacks and to mitigate their severity.

For these purposes certain remedies have been tried, and with happy results. Certain precautions are necessary during a fit; (1) the patient must be prevented from injuring himself; (2) no undue restraint should be employed as it tends to increase the violence of the fit; (3) all sources of pressure should be removed from the neck, and something should be put between the teeth to prevent injury to the tongue. Slight attacks may sometimes be prevented by closing the mouth and nose with a towel for a few seconds, but when the fit has once begun it is useless to try to cut it short. If the fits continue to recur very frequently, those measures should be employed which are recommended in cases of hysteria. Cold may be freely applied to the head, ice-bags to the spine, and inhalation of chloroform or nitrite of amyl (two to five drops) may be used to arrest or ward off the fit. During the state of pallor showing spasm of the vessels, or impending paroxysm, the premonitory symptoms may be warded off by this latter remedy. It is said that in cases in which the fit is preceded by an aura epileptica, a ligature between the part from which the sensation starts and the trunk prevents the attack, but the consequences of the adoption of this plan are that the patient feels worse and the next fit is more severe. If the head is hot, apply cold; if the feet are cold, apply warmth.

During the interval we must ascertain the source of the mischief, and if possible remove it; and also improve the state of general health by iron, cod-liver oil, and baths, and give tone to the nervous system. The persevering use of large doses of hyoscyamus, judiciously given, sometimes produces excellent results. Bromide of potassium in half-drachm doses three times a day and continued for some time checks the recurrence of the fits and diminishes their severity in a very decided manner, but where the fits occur only in the night, the bromide alone does not produce desirable results. Its use should be discontinued if it produce (1) somnolence, (2) confusion of ideas, and (3) uncertainty of gait. Some recommend a combination of bromide with conium, belladonna, and digitalis in large doses. If the patient is anæmic, iron, cod-liver oil, and nourishing diet are especially indicated. Where epilepsy is due to some structural mischief in the brain or skull, the application of setons or issues to the nape of the neck, or of some blistering fluid to the neck followed by pustulating ointment is often serviceable. Repeated dry cupping to the neck is also of benefit. Leeches to the neck have a desired effect by reducing the undue reflex irritability of the medulla oblongata and preventing congestion which causes convulsions. Narcotics are useless in these cases, for they tend to increase the reflex irritability and the convulsions become stronger. The general use of narcotics is to allay exalted sensibility or pain, which is not present in epilepsy. The anti-epileptic drugs highly prized are (1) atropine in $\frac{1}{100}$th grain doses given for months. Under its use the fits diminish in force and frequency. In long standing cases it is a very useful remedy. It is often used in recent cases. The extract of belladonna may also be given in doses of from one quarter to one third of a grain. It should be continued for about one month. Some practitioners prescribe atropine one grain in rectified spirit one drachm—of this, a drop dose is to be taken. (2) Bromide of potassium. When cardiac complication is associated with epilepsy, a combination of digitalis and bromide is superior to the bromide alone. Cannabis is useful when epilepsy is associated with headache, and in such cases tincture of gelsemium may also be combined with the bromide. Aconite is sometimes added, and even iodide of potassium, to increase the effects of the bromide. Oxide of zinc, either alone or combined with the bromide, often does good service. It should be tried when the bromide fails. Like other remedies, it is more useful in acute than in long-standing cases. It should be given an hour after each meal, the dose varying from two to five grains. Its use should be extended over several weeks. The sulphate, phosphate, valerianate, acetate, and lactate of zinc have also been tried from time to time with success. Turpentine is a favourite remedy with some authors, and may be given with benefit. The ammoniated sulphate of copper and the nitrate and the oxide of silver have been found efficacious. Cotyledon umbilicus was formerly much used, but it cannot be depended upon. Iron when given is often attended with permanent improvement, and in many cases has arrested the fits. The subcutaneous injection of curara, or Indian arrow poison, has been attended with benefit; borax may be given in fifteen grain doses three times a day, when all remedies fail. In some cases, the injection of apomorphia, so as to cause nausea, and thus to relieve spasm, has served to arrest the attacks. It is to be injected in doses of one-twelfth of a grain. Digitalis, ergot, datura and even strychnine have been given. The continuous galvanic current has a sedative action and may be applied to the spine. It is especially important that epileptic patients should enjoy refreshing sleep. The diet should be simple, nutritious, given at regular hours, with a moderate quantity of stimulants. The patient should have daily exercise, go early to bed, have a daily bath and a quiet easy occupation. Attention to the secretions is necessary. If, as often happens, constipation is present, a combination of extract of aloes one to two grains, extract of belladonna one-eighth of a grain and quinine one grain taken two or three times a week will be found very serviceable. When the affection depends upon syphilis large doses (20 grains per dose) of iodide of potassium must be given. Distant sources of irritation as uterine derangement in females and phymosis in males must be properly dealt with. Occasionally the disease may be arrested by the adoption of various plans: placing a ligature round the arm sometimes stops the attack and sometimes a blister to the part where the aura was commencing appears to check the advent of the paroxysm. The fits are occasionally arrested by the invasion of other morbid conditions, as typhus fever, erysipelas, or rheumatic fever.

TETANUS—LOCKJAW—TRISMUS.

Tetanus, like chorea, is a disease or derangement of the motor nervous system. In this as in other spasmodic diseases, there is increased excitability of the motor nerves, the sensory nerves being but slightly affected. The evidence at present collected points to its being a functional and not a structural disorder. The post-mortem examinations in cases of tetanus have yielded little or no information as to the seat and nature of the lesion. The vessels of the spinal cord sometimes appear to be full, and sometimes the cord is softer than natural. There is no degeneration of the elements of the cord, as is shown by the fact that motor impulses are absent in cases where the cord is destroyed. At the commencement the spasms are due to the action of some appreciable irritant, which acting upon the extremities of the peripheral nerves, throws the cord into a state of excitement and spasms result. These spasms are very violent and of long duration, owing to the fact that the excitement of the spinal cord, once set up, persists for a considerable period.

Tetanus is a disease characterised by violent tonic spasms of the muscular system. It so closely resembles the effects produced by the poison of strychnia, that it is often said to exist in three varieties, differing only in cause—traumatic, idiopathic, and toxic. Its course is short, violent, and usually fatal.

Causes.—Tetanus is more frequent in hot and tropical climates than in cold, and in hospitals than in private houses. In most cases it succeeds a wound, more often a ragged and punctured or gunshot wound than a clean cut, and is more frequent after an injury of the extremities than an injury of the head or trunk. It occurs at variable periods; sometimes immediately after the infliction of a wound, sometimes after cicatrization has taken place. In many cases it is believed to be of idiopathic variety, as lockjaw following the effects of cold, but some breach of surface is generally discoverable on more careful observation; cases, however, in which no injury at all is present undoubtedly occur, though they are very rare. The tetanus of new-born children which occurs between the first and fifth day after the fall of the cord is of traumatic origin, as was first shown by Trousseau in a famous clinical lecture, in which he compared with great skill the severed cord with the stump of an amputated leg. Some writers have maintained that the presence of dirt in the wound increases the chance of tetanus, and there is no doubt of the fact that tetanus neonatorum, fatal cases of which used frequently to occur in London lying-in hospitals, has become almost extinct since the advance of hygiene. It is still common among the inhabitants of St. Kilda, the most remote of the Hebrides, where children are born in little cabins reeking with turf smoke, and with the odour of dried fish and of oil of sea-birds. Other factors are doubtless present, such as a sudden fall of temperature during the night following a hot day, as has been observed in cases of tetanus in a surgical ward.

Traumatic tetanus is of a far more frequent occurrence than the idiopathic and toxic forms. It is more common in men than in women, and in the strong and robust than in the weak and debilitated. Certain races, as negroes, are very prone to it. It is often seen in the Calcutta hospitals, and occasionally prevails in an epidemic form. Domestic animals, too, often suffer from the disease in the tropics after operations. The occurrence of tetanus is beyond doubt favoured by peculiar local circumstances and meteorological conditions, but the nature of these has not as yet been ascertained.

Symptoms.—The most marked symptom of tetanus is tonic spasms of certain portions of the muscular system. In cases of wounds, the disease generally sets in between the fourth and fourteenth day after injury. In idiopathic tetanus, the symptoms appear within a few hours after exposure to the assumed cause. The first symptoms which herald the advent of the malady are slight general febrile disturbance, and pain and stiffness of the muscles of the jaw and neck. The patient often supposes them to be due to exposure to cold, and regards them as mere sorethroat and rheumatic wry neck. Gradually, as the disease is developed, the head becomes fixed and drawn backwards, and the muscles of the neck are rigid and stiff. The patient has a difficulty in opening the mouth; there are spasms of the muscles of mastication; and the jaws are firmly pressed together, a condition known as trismus or lockjaw. At the same time there is difficulty of swallowing, due to spasm of the muscles of the pharynx and neck. Gradually the patient finds it difficult to speak, and the voice is weak. The stiffness now extends to the muscles of the trunk, and gradually to all voluntary muscles, except those of the hands, eyeballs, and tongue. The spasms of the extensors overpower those of the flexors, hence the body is curved, with the concavity forwards, and in severe cases rests on the head and heels, a condition known as opisthotonos. The entire body is rigid, like a bar: it can be raised upward without the neck giving way. When the [illegible] paroxysm. The fits are occasionally arrested by the invasion of other morbid conditions, as typhus fever, erysipelas, or rheumatic fever.

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cold douche to the affected part. In long-standing cases, the improvement of the appetite, digestion, and nutrition, local cleanliness, and avoidance of continued pressure over the anæsthetic part, constitute an important part of the treatment. Muscular anæsthesia when acute and sudden in its onset requires rest and counter-irritation. When long continued, faradisation may be useful. In all cases of anæsthesia, inquiries should be made as to syphilis; and if there be any history of the complaint, specific treatment must be adopted.

HYPERÆSTHESIA.

It is a very common symptom in hysteria. It signifies derangement of sensibility. The power of tactile discrimination is morbidly increased for sensations of weight, pressure, and temperature. Other senses, as those of sight, smell, hearing, and taste are sometimes similarly affected, and the patients often feel disgusted by bright lights, loud voices, or strong scents of flowers. This condition of morbid increase of general sensibility is often associated with perversion of feelings and intense dislike for objects of sight, smell, or taste which always afford a sense of gratification to healthy individuals. Such patients often suffer from a sort of idiosyncrasy for certain objects. Hyperæsthesia may or may not be associated with pain. In neuralgias the tender spots (points douloureux) are generally hyperæsthetic, and excessively sensitive on being touched. Pressure on them often causes more pain, which cntinues for some time after the pressure is removed. In anæmic women, in hysterical patients, and those suffering from chronic nervous disorders, cutaneous hyperæsthesia is often found in the skin of the abdomen, simulating peritonitis, and in that of the chest, where it may be mistaken for pleuritis. The skin of the arm is often equally hyperæsthetic. Hyperæsthesia exhibits the following diagnostic features:—1. The part is sensitive to mere contact or slight pressure of the tips of the fingers. 2. Firm pressure is generally borne without pain. 3. The sensitiveness is less when the attention is withdrawn from the affected spots. That hyperæsthesia is local and limited is known by passing near the part (1) a feeble current of electricity; (2) a hot sponge or a piece of ice; (3) by making pressure with the fingers. In every case the tender points are thus rendered evident.

the rise of temperature sometimes takes place after death. In these cases the bowels are generally constipated.

Terminations.—Death may be sudden, or occur in a few hours or several days after the setting in of the disease. The source of greatest danger is stoppage of respiration. There is no obstacle to the entrance of air, but the rigidity of the respiratory muscles and the spasmodic contraction of the diaphragm completely arrest respiration, and cause death by suffocation. In a majority of cases death is gradual, the cramps, pain, and dread of suffocation continue with remissions until the patient dies from exhaustion, or from carbonic acid poisoning. Where the disease continues for weeks, emaciation and exhaustion, due to privation from inability to take food, end the scene. In favorable cases, sleep returns during the remission, gradually the paroxysms lessen in duration and severity; the intervals between the exacerbations become longer and longer, and the patient is able to take nourishment. The muscles gradually lose their rigidity and stony hardness, and become soft.

Tetanus neonatorum, otherwise known as trismus nascentium, is a peculiar form of tetanus. It is very common in tropical countries, and is popularly known as nine day fit. Many cases occur in infants about the second or third week after birth. Recovery is extremely rare. The infant, after a few days of illness, loses flesh very rapidly. The disease is preceded by a few premonitory symptoms. The child cries frequently, and does not take breast or feeding-bottle. As the meconium is not properly discharged the child's body has a yellowish tinge, and the eyes and lips are surrounded by bluish areolæ. The jaws stand apart, and the muscles of the face become convulsed. The forehead appears wrinkled, the eyelids are spasmodically closed, and the alæ nasi are dilated. The back is curved and stiff; any attempt to touch or to move sets up convulsions. In such cases care should be taken to guard against cold or foul air. The child often dies from suffocation in a few hours. Sometimes the breathing becomes laboured, and life is prolonged for a few days, during which the child pines away, and at last dies by carbonic acid poisoning.

Prognosis in cases of tetanus is extremely grave. The mortality is at the rate of 88 per cent; 55 per cent. of cases die within the first five days. If the twelfth day be reached the patients generally survive. In all cases the temperature of the patient is a guide in the prognosis. There is little danger so long as this remains below 101°. If 103° be reached, a fatal issue is to be expected.

Diagnosis.—Tetanus is often confounded with a spasmodic affection confined to the muscles of mastication. In local trismus there is the history of disease of the mouth or jaw, and the absence of spasm in the muscles of the neck and trunk. Opisthotonos sometimes occurs as a symptom in cerebro-spinal meningitis, basilar meningitis, and myelitis. In these diseases the curvature of the spine is not so well marked as in tetanus, and there are also cerebral symptoms, as delirium, coma, paralysis, and convulsions, which do not occur in tetanus. In some cases of hysteria opisthotonos and lockjaw are marked symptoms, as in tetanus, but in the former there are other recognised hysterical characteristics. Moreover, in hysteria the spasms occur in paroxysms, alternated with complete intermissions.

Spasms induced by poisonous doses of strychnia somewhat closely resemble those of tetanus. In strychnia poisoning there is a history of the poison having been taken for self-destruction, or given by others. In strychnia poisoning the fits occur in paroxysms alternating with distinct and complete intermissions. The intermissions generally last for a few moments, rarely for an hour. In tetanus there are no such distinct intermissions, but exacerbations and remissions. In strychnia poisoning, lockjaw is generally absent, and when present it is only slight, and then associated with opisthotonos. In tetanus the lockjaw is a marked symptom, and precedes opisthotonos. In strychnia poisoning the spasms especially affect the limbs, and are most intense there; in tetanus the limbs are less decidedly affected than the rest of the body. In strychnia poisoning the spasms come on within an hour after the drug has been taken, and they quickly become intense. The symptoms pursue a rapid course, and death or recovery ensues in a few hours as a general rule. Tetanus develops slowly, and gradually attains its intensity, and death usually takes place only after several days have elapsed. In strychnia poisoning the temperature does not rise as in tetanus; on the contrary, the temperature is low. The vomited matters contain the poison, which can be chemically detected.

Treatment.—In every case attention must be directed towards relieving the loaded bowels. This can effectively be done by a calomel purge. The danger of death from spasms is very great. In cases where the disease is prolonged, it destroys life by exhaustion. The paramount object of treatment is to allay or to diminish muscular contractions. The disease involves a considerable amount of suffering. As idiopathic cases are often due to exposure to cold, warm baths are indicated. The patient at the very commencement should be put into a tub of warm water, and kept there from ten to fifteen minutes. The relief thus obtained is considerable. Our chief aim ought to be directed towards removing or alleviating the irritability of the spinal cord, with the view of producing relaxation of the contracted muscles. For this purpose narcotics, as opium and tobacco, have been given, but without any good results. The narcotics, however, are useful in so far that they relieve the pain and agony which the patient suffers.

Narcotics should be given in very large doses, but their effects in producing narcotism should be watched. If the patient cannot swallow, injection of morphia hypodermically may be tried. Alcohol, in the form of brandy and wine, and other stimulants, as carbonate of ammonia, have been given with some success. Chloroform given by inhalation so as to keep the patient in a state of insensibility for a long time is more effective in producing relaxation of the contracted muscles. Hydrate of chloral and bromide of potassium act in a similar manner, and must be given in large doses. Calabar bean has been used with very great benefit. It should be used at the very beginning of the attack. If the patient can swallow the liquid extract may be given by the mouth. It should be given in small and increasing quantities every hour, till it produces paralysis or relaxation of the muscles. Where the convulsions are severe and produced on the least provocation, subcutaneous injection is highly recommended. It should be practised with great care and watchfulness. Some cases require larger doses than others. Nitrite of amyl by inhalation may also be tried. Cannabis Indica, aconite, and belladonna are remedies which deserve further trial. Great benefit is said to have resulted from the use of curara. A solution is used for hypodermic injection. One grain of the drug is mixed with 100 drops of water, and of this ten drops are injected at a time. Cold by means of ice applied to the spine is very beneficial in tetanus. Under its use muscular tension is diminished. Absolute rest to body and mind is of course indicated. The patient should be protected against exposure to cold or any blast of wind. He should be placed in a dark but well-ventilated room, and every source of irritation, as strong light, discordant noises, irritant articles of food or drink, must be avoided. Diet is all-important. Many cases recover under a supporting plan of treatment. The diet should be liquid but nourishing, and given in small quantities and repeatedly. It should also be assisted by stimulants as brandy. It is very desirable to produce sleep. Thirty or forty grains of hydrate of chloral may be given every night till natural sleep is obtained. If the patient cannot swallow, feeding by the rectum is likely to do good. Feeding by the stomach-pump through the nose or mouth should be avoided, as the introduction of the tube is likely to produce spasm and distress.

Where tetanic symptoms are due to strychnia poisoning, the poison should either be expelled by means of the stomach-pump, or its effects counteracted by suitable antidotes. As strychnia in full doses kills the patient in a few hours, prompt and effective measures are highly necessary. If the case is seen early, the stomach should be washed out by means of the stomach-pump, or evacuated by an emetic of mustard. Tannin or strong infusion of tea and charcoal are then likely to be of service. For the spasms chloroform inhalation is a prompt and efficient remedy, and should be persevered with for several hours if necessary. Hydrate of chloral is also likely to produce good results.

HYSTERIA.

Hysteria is defined to be a functional nervous disorder (neurosis) assuming the most varied forms. The various manifestations occur either alone or in combination in any individual case, the disease commonly presenting a paroxysmal character. The principal phenomena which characterise the disease are as follows:—(1) A flow of limpid urine; (2) uneasiness and irregular motor functions as paralysis or spasms; (3) rumbling noises in the left iliac region; (4) the sensation of a ball (globus hystericus) rising upwards to the throat, and frequently attended (5) by a feeling of suffocation or spasm of the glottis, and (6) sometimes by convulsions and coma. The disease chiefly attacks females from the period of puberty to the decline of life, and principally those possessing great susceptibility to mental impressions. The organs of generation, and particularly the uterus, are not necessarily the seat of disorder in every case. The hysterical condition may exist alone or as an element in many other diseases. It is likewise represented by certain mental characteristics. There is increased or morbid susceptibility to emotional excitement, associated with impairment or loss of self-control. It is rare or unknown among the ignorant and working classes of India, whose sensibilities are blunt. It is most common among those whose luxurious habits and ungratified desires predispose them to morbid excitement. The name implies an affection peculiar to women, and originating in the sexual system and chiefly in the uterus. Similar symptoms are, however, seen in the male sex also. It is said to be due to nutritive derangements of the general nervous system, the disease originating in the nerves of the organs of generation. The excitement is often transmitted from these nerves to other nerves, and to the central organs.

Causes.—*Age.*—It generally occurs at from fifteen to twenty-five years of age, because of the radical change the nervous system then undergoes, but it may occur in childhood and in advanced age. As age advances it becomes more rare, because the mind is more settled and less influenced by sudden emotions and morbid impressions. Females suffer more than males. In the former the power of controlling or exercising the influence of the will is more liable to be lost or impaired. This difference is due to the different ways in which the two sexes have been trained and educated. Widows, married women without children, and single women are most susceptible to it. Irritation of the sexual apparatus, due either to excessive coitus, or to imperfectly effected coitus, or to onanism, or mere sexual excitement, leads to it. Prostitutes, though indulging in excessive sexual intercourse, are generally exempt from it. Heredity is a common cause. Children born of hysterical parents often suffer from hysteria or some other forms of nervous disorder. A tendency, either congenital or acquired, to nervous disorder, is also a common factor in inducing hysteria. Many attribute it to disordered menstruation and various diseases of the uterus, as flexion, ulceration, &c., but its frequency in women as due to these causes has been very much doubted. In some cases it can be traced to physical disorders, and to chlorosis, to derangement of the alimentary canal with long-continued constipation. In girls who are over-petted, who lead an idle, luxurious, or fashionable life, read amorous tales, whine for lovers, or cherish an ardent longing for a particular object, the affection is very common. It is not confined to any climate or country, and those living in town suffer as often as the country people. In women, though physically very healthy, there is a propensity towards a rapid development of various impressions upon their nervous system. During health the influence of terror or extraordinary emotion upon the minds of those who may not be hysterical is often very great. Under these influences they stand thunderstruck or become completely anæsthetic, or the muscles of their limbs become relaxed. Such emotions often lead to excitability of the vaso-motor and trophic nerves, as shown by red cheek or pale face. These impressions are only temporary. In hysteria the state of mind is peculiar. It is guided by external accidents, and depends upon the impressions made by those accidents upon the sufferer. The mode of life has a great influence in producing hysteria. The disorder is much more common in women married to impotent men, in those who find their social claims not well respected by their husbands, and in those whose expectations with regard to their position, pleasures, &c., are disappointed.

Symptoms.—In this disease, like epilepsy and eclampsia, there is some disorder of the nervous system. The sensory, motor, and psychical functions are disturbed. These changes are associated with disorders of the circulatory and nutritive systems. In hysteria there is very often increased sensibility of the cutaneous nerves and of the motor (muscular) nerves, as evinced by hyperæsthesia and spasms. On the other hand, the sensibility may be diminished, and anæsthesia and paralysis may result. The disorder affects the nervous system in general, both central and peripheral.

The symptoms of hysteria may be divided into those of the hysterical attacks and those of the hysterical state. The clinical phenomena during the fit or during the paroxysm may be arranged as (1) those affecting the mind (psychical disturbance); (2) derangements of sensibility; (3) derangements of motion; (4) vasomotor and nutritive derangements; (5) those which simulate organic disorders. Derangement of sensibility, or a state of excitement of the sensory nerves, is a most common symptom, and is seldom absent. When this condition of hyperæsthesia is a prominent feature, the patients are extremely nervous, and may remain so for years. They experience an unusual acuteness of the senses, and they present various signs of morbid irritability. They have acute pain when touched; the pain is increased on handling, even if the eyes are closed. Their sense of smell, hearing, and vision is equally acute; ordinary noises, strong smells, and even a very bright light, are quite intolerable. When one is speaking aloud they get annoyed and irritated. Another symptom of deranged sensibility is pain, the patient often complaining of acute pain (neuralgic) under the ribs, and of headache, mastodynia, and pains in the abdomen and loins. The pain may be confined to a limited spot or a point in the head. Clavus hystericus is a circumscribed pain on one side of the sagittal suture. There is sometimes acute pain in the knee (arthropathia hysterica), so severe as to be mistaken for inflammation. In some cases, instead of exalted excitability there are manifest symptoms of anæsthesia, involving a great portion of the surface of the body, but no numbness.

All these derangements of sensation are often connected with perverted sensations of internal organs, simulating organic disorders. Hysterical patients often complain of violent palpitation of the heart and throbbing of the vessels in the neck, and of epigastric pulsation, while in reality the heart beats regularly. They often complain of difficult breathing, of necessity for frequent respiration, of hiccough, and of a feeling of fulness and constriction about the chest. These sensations, not being due to any organic disorder, confirm the diagnosis of hysteria. Such patients frequently complain of deranged digestion, constipation, a sense of oppression and fulness in the epigastrium, cardialgia, and of great thirst. They have frequent desire to pass urine, although the bladder may be almost empty, and they often evince a disinclination for sexual intercourse.

With regard to motor disturbances, there may be either convulsions or motor power may be diminished. In the former case there is morbid excitement of the motor nerves proceeding from the spinal cord and medulla oblongata, giving rise to spasms. In hysteria convulsions never cause loss of consciousness as they do in epilepsy. The convulsions are supposed to be of a reflex origin; the impressions from the sensory nerves, or from nerves of special sense, are transmitted to the cord, and through it to the motor nerves and to the muscles. In many cases there are twitchings of one or more of the limbs. The spasms recur very frequently, on the least excitement or on any irritation acting upon the sensory nerves. The convulsive twitchings are often associated with rigidity of different muscles. The spasms may be tonic or clonic. Tonic spasms affecting the pharynx, or extending from below upwards, give the sensation of a ball rising into the throat, and known as globus hystericus. The spasms often extend more or less over the whole body, and hence opisthotonos, emprosthotonos, and pleurosthotonos are often seen. Clonic spasms simulate chorea or epileptic convulsions. These affect the face, trunk, and extremities, and frequently also the muscles which are employed in the expiratory movements, as in laughing, yawning, or weeping. The barking or the howling sounds which hysterical patients sometimes make are due to spasm of the rima glottidis and of the vocal cords; such patients are frequently subject to a troublesome cough, due to the same spasm. Abundant flatulent eructations, lasting for several minutes or even for hours, are common, and when they occur the attacks are often repeated at very short intervals. They are often associated with a good deal of belching, and attended with loud sounds. Hysterical patients often suffer from symptoms of paralysis; there may be hemiplegia, or paraplegia, or general paralysis with loss of motion, the sensation being not impaired. That the paralysis is not peripheral is shown by the fact that the electrical contractility is retained in the palsied muscles. Its cause is in the brain, though not in any structural change, but in slight derangement of nutrition of the nervous system or of the centre of volition. The derangement of the centre of volition is known by the patient's indecision in performing movements, or incapacity for generating motor impulses. The paralysis may last for a long time. Such patients may suffer from paralysis of almost any muscles, but those of the limbs are mainly affected as a general rule. In some cases there is anæsthesia of the skin. In rare cases facial paralysis and even ptosis may be observed. Sometimes tympanitis occurs, and may be very severe. Apparent paralysis of the diaphragm and of the bladder is not unfrequent.

In hysterical paralysis the limbs do not waste, and, as a rule, the paralysis is incomplete. The palsy in many cases disappears at times and reappears again. In hysterical hemiplegia the patient walks without any swinging movements, she merely drags her legs and the toes are raised. In hysterical paraplegia the left leg is generally more affected than the right, and if left unsupported while walking she manages to prevent herself from falling to the ground. The bladder and rectum are unaffected. In such patients the voluntary movements are generally defective, whereas all kinds of involuntary movements are exaggerated or readily excited. When asked to speak she can do so in a whisper not due to paralysis of the larynx, for under the influence of strong emotion this loss of speech (aphonia) disappears at once.

Derangement of the vaso-motor system.—In these cases the temperature is reduced. The extremities are cold, while the face is reddened, and there is a burning sensation all over the skin of the face. The derangement of innervation leads to determination of blood to the kidneys, and there is profuse discharge of pale limpid urine. Its accumulation without the patient's knowledge sometimes takes place, and it is often voided unconsciously. With regard to evidences of mental derangements the patient is often semicomatose, and very often suffers from morbid emotions. The psychical derangements lead to sudden transitions from extreme gaiety to profound gloom. Such patients are generally sad or unhappy, and in despair about their fate or life. They are prone to cry and sob. Other symptoms more or less frequently present are extreme talkativeness or complete silence, uncontrollable laughter or shedding of tears, violent screaming or other manifestations of distress. Illusions and hallucinations are common. Such patients present a marked contrast by the absence of emotional manifestations when real calamity befalls them or their relations and friends. Under such circumstances persons of strong nerves may become hysterical; they lose their reasoning and prove themselves weak-minded.

In hysterical subjects the emotional faculties are unduly excitable; there is loss or impairment of self-control. The will and intellect are defective. Such patients are readily excitable, and indulge in exaggerated estimates of the subjective symptoms of their complaint. Thus, some believe that they are paralytic and cannot stand, but when off their guard they can do so perfectly well. They are either most despondent or extremely cheerful, and often talk a great deal of nonsense.

Symptoms of the fit.—As a rule, the fit does not come on during sleep, and occurs only when witnesses are present. It consists of convulsive movements of the trunk and limbs, beating of the breast, tearing of the hair, violent screams, gesticulations, or feeling of globus hystericus. The patient looks apparently unconscious, but is aware of what is going on around her, and looks out from under the eyelids occasionally. The fit may last only for a few moments; unlike epilepsy, there is no stertor, no lividity of the face, no dilatation of the pupils, although the eyes are turned from side to side. The pulse is generally quiet, and there is no biting of the tongue, but foaming at the mouth is often present. The fit ends with tears, outburst of crying, or obstinate hiccough or in exhaustion, and the patient is for a time insensible.

Phantom-tumour, otherwise known as hysterical tympanitis or spurious pregnancy, frequently occurs in hysterical girls. Phantom-tumour is a circular enlargement of the abdomen forwards, with a constriction below the margin of the ribs and above the pubes. The tumour varies in size; is quite painless, smooth, uniform, and moveable as a whole from side to side. Occasionally curious nervous phenomena, as motor, sensory, emotional, or intellectual disturbances are observed in connection with it. The feeling is quite distinct from that of a solid growth, accumulation of fluid, or of pure tympanitis. Vaginal examination reveals nothing abnormal. It is supposed to be due to paralysis of the intestines, due to some disordered nervous influence. Catalepsy with hysterical trance and ecstasy often coexists. These nervous phenomena originate in mental excitements, such as those connected with religious fervour. There are also changes in the blood-vessels, which may affect the skin or the various organs, and cause bleeding from the nose, lungs, stomach, or uterus. Even bleeding from the breasts and from the skin has been observed. In one case there was bleeding from the thigh.

Symptoms of spinal irritation are also common. Hysterical patients often complain of neuralgic pains in different situations, of muscular spasms, and of derangements of functions of various organs. These various symptoms are due to some mischief in the spinal cord or medulla oblongata. The disorder is purely functional. Some authorities designate this affection of the spinal cord as spinal irritation. In spinal irritation there is tenderness on pressure over various portions of the spine. The pain is localised, and its seat has reference to the nervous connections with the affected part. The patients generally exaggerate the symptoms. They are relieved by any local application, or by withdrawing their attention from the seat of pain. In such cases the patient generally lies on her back, and if treated as seriously ill or indulged, the affection is apt to last throughout life, and hence is rarely cured in patients belonging to the well-to-do classes of society.

Diagnostic features of hysterical convulsions.—In hysteria the convulsions are always associated with various other symptoms. These are (1) fits of laughter or weeping without any motive; (2) globus hystericus; (3) spasmodic contractions of the limbs; (4) mimic contractions of the muscles of the face; (5) increased or diminished cutaneous sensibilities; (6) hysterical coma or a state of unconsciousness, without stertor or embarrassed respiration and active pupils. Another distinction is constituted by the fact that the convulsions are not automatic. They are generally simulated and reveal the exercise of the will. They are often associated with epileptic or epileptiform convulsions. In such cases the symptoms of hysteria and epilepsy are combined. The disease sometimes dates its commencement from an attack of scarlet fever or some other eruptive fever. There may be no history of fright to account for it. There may be hereditary predisposition. The parents or other members of the family may be hysterical, epileptics, or idiots, or have suffered from apoplexy. In these cases the first epileptic fit occurs in connection with hysterical convulsions. The patient not having had epilepsy before now suffers from a violent fit, followed by a state of drowsiness lasting for some time. The attacks of epilepsy tend to recur with increasing frequency, and such patients gradually become weaker and weaker. There is inability to move about or even to turn in bed. After a time there is hemianæsthesia or numbness, and weakness in the limbs.

Treatment.—The treatment of the hysterical condition consists in—(1) invigorating the body and mind; (2) moral treatment; (3) removal of associated morbid conditions; and (4) anti-hysteric remedies. Much may be done by education and by occupation to improve the condition of hysterical patients. They may be taught to subdue their emotions, and, their intellectual faculties being trained in definite directions, they become accustomed to self-control. The cause of the fit should be ascertained, and, if possible, removed. Sexual excitement should be avoided, and all exciting causes of this kind should be removed. A change of scene and associations and regular bodily exercise are very useful in this direction. As the disease is mostly due to nutritive derangement, and chiefly to that of the nervous system, great benefit is generally derived from the repeated use of baths. Sea-bathing is often of great service. The various nervine tonics which have a great reputation as anti-hysterical remedies are: Castor, hartshorn, assafœtida, valerian, and other similar drugs, most of them possessing a very strong and disagreeable odour and taste. Valerian and assafœtida, given by the mouth or injected into the rectum, act admirably in relieving the paroxysms. Another nervine tonic of great efficacy is the chloride of gold and sodium. The best nervine tonic the native Hakeems use, and one I invariably prescribe in hysteria and in similar or allied nervous complaints, is Suvarna Malini Vasanta, a preparation which contains zinc, gold, pearls, &c.

If hyperæsthesia be present, bromide of potassium may be given with advantage in increasing doses when other remedies fail. Electricity is useful for the relief of various symptoms as anæsthesia, paralysis, neuralgia, &c. For anæsthesia the induced current is the best. It should be used in moderate strength over the entire surface. Besides electricity, strychnia and phosphorus may be given for the paralysis. Vomiting may be checked by creasote and acetic acid. Aconite in drop doses is useful to allay fluttering of the heart and nervous palpitation. By way of preventive treatment, some recommend hysterical girls to marry, but cases are on record of married women in whom hysteria was developed only after marriage. Such patients are a great nuisance to their husbands; have a great tendency to miscarry; their children are often still-born, are delicate, sickly, and even inherit hysteria. *During the fit* the patient should be left alone in a dark but well-ventilated room, sympathising friends being strictly excluded. The clothes about the neck should be loosened; cold affusions should be applied to the head and face; sinapisms to the præcordia and extremities; hot baths with mustard to the feet; onions or ammonia to the nostrils; the nostrils or the mouth should be closed by the hand, and assafœtida applied to the teeth or given internally. In obstinate cases the electric coil may be tried; some use inhalation of chloroform for these patients.

In all cases attention must be directed towards the removal of associated disorders. The anæmia which mostly conduces to hysteria, and the affections of the sexual organs, which lead to anæmia and then to hysteria, should be attended to. To quiet the nervous excitability, hydrate of chloral, opium, and alcohol are the three remedies which should be given for a short time only. Many patients after a long use of these drugs drift into a habit from which they never desist. The evil practice should be avoided. To invigorate the body and mind the patient should have plenty of exercise short of fatigue, daily ablutions, sea-bathing, and shower baths.

For phantom-tumour the doubt may be cleared up by putting the patient under the influence of chloroform, when the enlarge-

Symptoms.—These vary in different individuals according to their constitution and mental vigour. They also vary with the nature of the cause, and may be very mild and slow in their advent, or severe and rapid. The mild cases of collapse are seen in the course of fever and other diseases, the condition being indicated chiefly by cold extremities. Such cases, however, often assume very serious forms. 1. In severe cases the patient looks death-like. 2. The functions of respiration and circulation seem to have ceased. They are detected only on careful observation. 3. There is complete loss of vitality; (*a*) the pulse at the wrist is almost imperceptible; (*b*) the heart's action irregular, fluttering, and rapid, or almost imperceptible; (*c*) the face is deadly cold and of a leaden hue; (*d*) skin cold and clammy; (*e*) features sunken and relaxed; (*f*) eyes staring, conjunctivæ insensible to light; (*g*) nostrils dilated. 4. Respirations are slow, feeble, and irregular, sighing or gasping; inspirations take place only at intervals. 5. Extreme muscular debility. The patient lies apathetic and listless. The limbs appear paralysed. Notwithstanding all these symptoms the consciousness is retained.

In fatal cases the respirations become slower and slower, each ending with a deep sigh. The pulse ceases to beat, and the heart's action becomes imperceptible.

In cholera the symptoms of collapse are most marked. The patient in a state of collapse looks like a corpse, and only now and then moves convulsively, owing to the pain of the cramps.

SHOCK.

Shock is a condition of extreme nervous depression. In this respect it resembles collapse. In the former, however, the nervous exhaustion is sudden, and may occur in a person previously healthy. In collapse there is precursory nervous exhaustion. Shock indicates sudden depression of all the functions of the body.

Causes.—These are numerous. 1. Extreme terror. 2. Startling news in persons of nervous and excitable temperament. 3. The sight of blood, or of a blister, or of an injury in persons who are extremely nervous. 4. Injury or pain is the most frequent cause. (*a*) Severe blow to the epigastrium. (*b*) Crushing of a finger or hand in machinery or by other accident. (*c*) Extensive burns or scalds. (*d*) Violent spasmodic pain, as in hepatic or renal colic. (*e*) Serious accident, as a fall from a carriage or horse; loss of blood, as after delivery. Serious operations, as ovariotomy, removal of the uterus, amputation of a limb, &c., are occasionally attended by shock. In rare cases tapping of a hydrocele or the opening of an abscess causes symptoms of shock.

Pathology.—There is depression of all the vital functions, associated with diminished supply of blood to all the tissues of the body. The temperature in the axilla and mouth is lower than natural, showing coincident diminution of tissue changes. The depressed condition of the circulatory function is shown by shrivelled and blanched skin, by thready and barely perceptible pulse. The withdrawal of blood from the brain is manifested by feeble pulsation in the carotids, by anæmia of the retinal vessels, and by mental depression. Blood being thus withdrawn from the general circulation there results considerable distension of the abdominal vessels governed by the splanchnics. This distension leads to congestion of the abdominal viscera.

Symptoms of shock due, for example, to a severe blow on the epigastrium may be thus explained as caused by a paralytic dilatation of the visceral arteries, which is attributed to an inhibitory influence upon the splanchnics, through the medium of a special reflex centre, which is in communication with the sensorium and all parts of the body. Physiologists have discovered that the stimulation of the central end of the divided portion of the depressor branch of the vagus leads to immediate lowering of blood-pressure in the head, neck, and limbs, this effect depending upon a dilatation of the abdominal arteries and consequent flow of blood towards the abdominal viscera.

Symptoms.—The patient is stunned, and his vital powers become blunted. This is generally the case where shock is the result of a severe accident or blow. When the shock is the result of mental terror or calamity, the patient suddenly becomes pale and faint; there is trembling of all the limbs; the extremities are cold and covered with clammy sweats; each side of the nose and forehead is bathed with beads of sweat; the pulse is weak and very frequent; there is great mental confusion. These symptoms are often met with in nervous patients on whom any operation is to be performed. Even the presence of the medical attendant is sufficient to give rise to them. These symptoms may pass off in a few minutes, but often they last for an hour or two. There is yet another class of cases where the symptoms are more marked. Immediately after an operation (even tapping of a hydrocele) the patient becomes stunned; he loses his consciousness; his senses become blunted; the skin of the face and of the limbs appears deadly pale, and is bathed with sweats; the face has lost its expression, and looks ghastly and anxious. These symptoms are often followed by irregular contractions of muscles of the body; the eyes are dull and motionless, and the pupils dilated; the pulse is very feeble, barely perceptible, and very rapid. The

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cold douche to the affected part. In long-standing cases, the improvement of the appetite, digestion, and nutrition, local cleanliness, and avoidance of continued pressure over the anæsthetic part, constitute an important part of the treatment. Muscular anæsthesia when acute and sudden in its onset requires rest and counter-irritation. When long continued, faradisation may be useful. In all cases of anæsthesia, inquiries should be made as to syphilis; and if there be any history of the complaint, specific treatment must be adopted.

HYPERÆSTHESIA.

It is a very common symptom in hysteria. It signifies derangement of sensibility. The power of tactile discrimination is morbidly increased for sensations of weight, pressure, and temperature. Other senses, as those of sight, smell, hearing, and taste are sometimes similarly affected, and the patients often feel disgusted by bright lights, loud voices, or strong scents of flowers. This condition of morbid increase of general sensibility is often associated with perversion of feelings and intense dislike for objects of sight, smell, or taste which always afford a sense of gratification to healthy individuals. Such patients often suffer from a sort of idiosyncrasy for certain objects. Hyperæsthesia may or may not be associated with pain. In neuralgias the tender spots (points douloureux) are generally hyperæsthetic, and excessively sensitive on being touched. Pressure on them often causes more pain, which cnntinues for some time after the pressure is removed. In anæmic women, in hysterical patients, and those suffering from chronic nervous disorders, cutaneous hyperæsthesia is often found in the skin of the abdomen, simulating peritonitis, and in that of the chest, where it may be mistaken for pleuritis. The skin of the arm is often equally hyperæsthetic. Hyperæsthesia exhibits the following diagnostic features:—1. The part is sensitive to mere contact or slight pressure of the tips of the fingers. 2. Firm pressure is generally borne without pain. 3. The sensitiveness is less when the attention is withdrawn from the affected spots. That hyperæsthesia is local and limited is known by passing near the part (1) a feeble current of electricity; (2) a hot sponge or a piece of ice; (3) by making pressure with the fingers. In every case the tender points are thus rendered evident.

PARÆSTHESIA.

It is a condition in which there is perversion of general sensibility. It indicates a condition distinct from excess or diminution, and characterised by numbness, formication, itching, and tingling.

HYPERCINESIS—SPASMS.

The term indicates abnormal contraction, occurring in single muscles, or in groups of muscles, or in organs composed partially or entirely of muscular fibres. There is increased excitability of motor nerves, the excitement being indicated by the contraction of muscles which they supply. There are two varieties, tonic and clonic. By tonic spasms is signified a series of quick and successive contractions of muscles with very little or no intervals of relaxation. The morbid impressions are permanent, and the consequent rigidity may continue, with greater or less intensity, for a considerable length of time. This is best noticed in tetanus and in strychnia poisoning. By clonic spasms is understood a series of involuntary contractions of voluntary muscles in quick succession, but the contractions are intermittent, or allow intervals of relaxation of the affected muscles. In this condition the affected muscles are in active and violent motion as long as the spasms last. In epilepsy, in blood-poisoning as in uræmia, in the convulsions of children and in women in the puerperal state, the paroxysms of convulsion are clonic. Convulsion is a term synonymous with spasm. In convulsions, the involuntary or automatic movements are general; they extend over a large surface of the body, are paroxysmal, and have a certain degree of violence. They may be slight or very severe, may be uniform or may be attended with exacerbations. In spasms, the movements are limited to local twitchings of a few muscles or of a single muscle; they are less forcible and of longer duration, and the pain is very annoying. The twitchings of a few muscles are best seen in tic, where the muscles of one side of the face are thrown into various contortions or grimaces, known as mimic expressions. In spasms of the diaphragm and of the glottis, the twitching is confined to a single muscle. Similarly in hysteria, the twitching is often confined to the tongue. In hydrophobia twitchings occur on an attempt to swallow fluids. Besides these involuntary movements other movements are produced by the will. In hysteria the convulsions are irregular, more or less violent and painless. They are partly voluntary and partly true spasms. Convulsions are sometimes feigned. Like anæsthesia, convulsive or spasmodic movements are

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Pathology.—During health voluntary movements are due to the impressions carried by the motor nerves from the grand centre of the will. Other movements, such as various contortions of the face in anger or weeping, or clenching of the fist in excitement, occur independently of the action of the will. Another series of motions, known as reflex movements, are purely automatic, and occur without the action of the will and even against the will. These reflex movements are due to centripetal impressions conveyed to a centrifugal channel. The act of deglutition and the respiratory movements are automatic movements; the former follows the introduction of food into the œsophagus, and the latter the collection of carbonic acid in the blood. The contractions of the uterus, of the heart, and of the bowels are due to reflex action. A variety of clonic spasms is known as *tremors*. In these, muscular fibres rather than muscles are affected, and to a far less extent than in convulsions.

SYNCOPE.

Syncope and fainting are synonymous terms. They denote a state of suspended animation, owing to a sudden failure of the action of the heart.

Exciting causes of syncope.—All those circumstances which interfere with the action of the heart. These are those directly acting upon the heart, or indirectly interfering with its action, through the influence of the nervous system or of the blood. Other causes are of a complex character. Fainting in women is largely under the control of the will. Lord Macaulay has noted that in the novel of 'San Sebastiano' the female characters fainted no less than twenty times; they always did it with a purpose, and in this the writer, who was a lady, showed an accurate knowledge of feminine pathology. In most men fainting is a very serious indication.

Direct causes.—Organic cardiac diseases as fatty degeneration; stenosis of the aortic orifice, with insufficient compensation, compression of the heart by tight articles of dress. Sunstroke, and excessive heat as of a Turkish bath, act upon the heart and may cause fainting. Inhalation of chloroform and the shock of lightning produce similar results.

Indirect causes, acting through the nervous system.—These act by first disturbing the nervous centres. Strong mental emotions or depressions, fear or grief in nervous and hysterical women. Severe and sudden brain-lesion, as concussion.

Other indirect causes which act through the nervous system and produce fainting are of a reflex nature. These are worms in the intestines, corrosive and irritant poisons in the stomach, diseases of the liver, kidneys or uterus. Women sometimes faint from uterine displacements. Severe pains in the limbs or body often cause fainting in debilitated subjects.

Indirect causes connected with the blood.—Various exhausting discharges and chronic hæmorrhage; anæmia, simple or pernicious, or anæmia due to chronic constitutional diseases.

Complex causes.—Fainting from want of food, or due to exhaustion, is partly owing to depressed action of the heart, partly to nervous depression, and partly to the want of blood. Similarly railway accidents cause fainting by affecting the whole system. Persons faint in a warm and crowded room, and in an impure atmosphere, owing to the effect of heat upon the circulation and of carbonic acid upon respiration and upon the heart.

Post-mortem appearances.—The organs generally are anæmic. In cases of fatal hæmorrhage the heart is contracted and empty. In other cases the ventricles are either dilated and full of blood or empty.

Symptoms.—There are three stages. The first precedes the loss of consciousness; in the second, the insensibility is more or less profound; in the third, the attack passes off and recovery gradually takes place. When the fainting comes on the patient turns suddenly pale; the extremities are cold and pallid; he leans against the nearest support; the eyes roll upwards and the eyelashes and eyelids are tremulous; the face is pinched and shrunken; the pulse frequent, irregular, weak or even imperceptible, or it may be slow and intermittent. Respirations are sighing, irregular and laborious; there is a feeling of constriction about the chest and confusion of mind. Vomiting may possibly occur. Subjective symptoms are likewise present. There is a sense of sinking at the epigastrium, and of giddiness in the head; there are noises in the ears, and vision is indistinct. In some cases there is restlessness and delirium. In severe cases the fainting is complete, the muscles are relaxed. The patient lies motionless, or falls with eyes half closed and slightly twitching; the consciousness is completely lost. General convulsions very often set in, and the sphincters are relaxed. These cases last a variable time and terminate either in recovery or death. Recovery is marked by a gradual return of consciousness, and by more or less reaction. The skin resumes its original colour and smoothness, the circulation returns, and the functions generally are restored. There are slight movements of the hands and features, with deep sighing. The temperature rises from 92° to 98·4°. Fainting may last from a few seconds even to hours. When due to hæmorrhage or organic disease of the heart it is often fatal.

Pathology.—There is a sudden failure of the action of the heart, leading to general feebleness of circulation, or to a condition of general anæmia. In such cases the systole becomes short and feeble. It has been found that where there is fainting without preceding hæmorrhage, on post-mortem examination the right cavities of the heart are distended with blood; but in cases of profuse hæmorrhage, the heart may be entirely deprived of blood. In either case there is cardiac paralysis. The feeble circulation affects the central nervous system. In the erect or standing posture the force of the circulation fails first within the cerebrum, and there is loss of consciousness. Its failure in the other centres has a depressing effect, and hence the circulation, respiration, and stomach, which are regulated by them, are affected. Sudden circulatory disturbance in the basal ganglia and cord leads to convulsions. The senses are likewise obscured. The depression of temperature is due partly to the failure of circulation of blood in the exposed parts, but chiefly to the arrest of the disintegrating processes, and also of the vital processes.

Treatment.—The cause must be sought for and removed. The next important indication is to restore the healthy action of the heart. During the fit the patient should be placed in a horizontal posture. All clothes about the neck, chest, and abdomen should be loosened. Fresh air must be admitted and overcrowding avoided. To restore the healthy action of the heart stimulants are requisite. Brandy alone or with water may be given, its quantity varying with the individual peculiarity. Carbonate of ammonia, ether, musk, and even eau de Cologne may also be employed. If the patient cannot swallow, brandy and milk may be given by the rectum. Ether may be injected under the skin of the præcordial region. Other means of exciting the heart's action by reflex irritation of the nerve-centres may be had recourse to. For this purpose cold water may be dashed on the face, and ammonia or eau de Cologne or onions applied to the nostrils; eau de Cologne may also be applied to the temples and hands. The extremities may also be rubbed with stimulating liniments or powdered ginger. Galvanism is also likely to be serviceable, one pole should be placed over the præcordia and the other in the patient's hand. Transfusion of blood may be practised in cases of syncope due to hæmorrhage. In all cases of fainting the heart should be carefully examined. The condition in question is sometimes the first symptom of aortic stenosis. In patients debilitated from typhoid fever or other exhausting diseases, the utmost care should be taken to prevent them from assuming the erect position too suddenly. Fatal syncope has occurred in cases when this precaution has been neglected.

COLLAPSE.

It is a state of extreme nervous prostration. It is a condition in many respects opposite to that of fever, being generally attended with diminution of temperature. It is, however, worthy of remark that in some cases of collapse, the temperature is many degrees above the normal, whereas there are cases of general depression of temperature of the body without any collapse associated therewith. The last condition is common during convalescence from fever or during the remissions. When collapse is extreme the vital functions are more or less in a state of abeyance. Collapse as a termination of disease has been already referred to (see vol. i, p. 166).

Pathology.—The ganglionic centres of the medulla oblongata are more or less involved, and there is obvious derangement of function of one or more of these centres. There is loss of energy of the cardiac, respiratory, and sensorial functions. The condition presupposes previous nervous exhaustion.

Causes.—Circumstances which lead to abnormal emptying of the cavities of the heart, as severe injury attended with profuse hæmorrhage, rupture of any of the abdominal viscera, rupture of the heart and of great vessels, sudden removal of pressure from the great vessels, as in operations of paracentesis abdominis or paracentesis thoracis. Extensive burns or scalds are attended with a similar result. Severe and prolonged pain as in colic, in stone in the kidney, and during the passage of gall-stones through the duct, often causes collapse. In acute inversion of the uterus, the sudden twisting of the peritoneum induces collapse. Other causes are impure and poisoned blood, as blood containing urea, tobacco or arsenic. Collapse often follows severe vomiting or purging. It is the terminal stage of epidemic cholera. Patients suffering from virulent types of fever generally become collapsed. Very large doses of quinine given in pernicious malarial types of fever, in collapse, and in cases of copious hæmorrhage from some internal organ, as the lungs or intestines, have sometimes caused [illegible] prostration.

Symptoms.—These vary in different individuals according to their constitution and mental vigour. They also vary with the nature of the cause, and may be very mild and slow in their advent, or severe and rapid. The mild cases of collapse are seen in the course of fever and other diseases, the condition being indicated chiefly by cold extremities. Such cases, however, often assume very serious forms. 1. In severe cases the patient looks death-like. 2. The functions of respiration and circulation seem to have ceased. They are detected only on careful observation. 3. There is complete loss of vitality; (*a*) the pulse at the wrist is almost imperceptible; (*b*) the heart's action irregular, fluttering, and rapid, or almost imperceptible; (*c*) the face is deadly cold and of a leaden hue; (*d*) skin cold and clammy; (*e*) features sunken and relaxed; (*f*) eyes staring, conjunctivæ insensible to light; (*g*) nostrils dilated. 4. Respirations are slow, feeble, and irregular, sighing or gasping; inspirations take place only at intervals. 5. Extreme muscular debility. The patient lies apathetic and listless. The limbs appear paralysed. Notwithstanding all these symptoms the consciousness is retained.

In fatal cases the respirations become slower and slower, each ending with a deep sigh. The pulse ceases to beat, and the heart's action becomes imperceptible.

In cholera the symptoms of collapse are most marked. The patient in a state of collapse looks like a corpse, and only now and then moves convulsively, owing to the pain of the cramps.

SHOCK.

Shock is a condition of extreme nervous depression. In this respect it resembles collapse. In the former, however, the nervous exhaustion is sudden, and may occur in a person previously healthy. In collapse there is precursory nervous exhaustion. Shock indicates sudden depression of all the functions of the body.

Causes.—These are numerous. 1. Extreme terror. 2. Startling news in persons of nervous and excitable temperament. 3. The sight of blood, or of a blister, or of an injury in persons who are extremely nervous. 4. Injury or pain is the most frequent cause. (*a*) Severe blow to the epigastrium. (*b*) Crushing of a finger or hand in machinery or by other accident. (*c*) Extensive burns or scalds. (*d*) Violent spasmodic pain, as in hepatic or renal colic. (*e*) Serious accident, as a fall from a carriage or horse; loss of blood, as after delivery. Serious operations, as ovariotomy, removal of the uterus, amputation of a limb, &c., are occasionally attended by shock. In rare cases tapping of a hydrocele or the opening of an abscess causes symptoms of shock.

Pathology.—There is depression of all the vital functions, associated with diminished supply of blood to all the tissues of the body. The temperature in the axilla and mouth is lower than natural, showing coincident diminution of tissue changes. The depressed condition of the circulatory function is shown by shrivelled and blanched skin, by thready and barely perceptible pulse. The withdrawal of blood from the brain is manifested by feeble pulsation in the carotids, by anæmia of the retinal vessels, and by mental depression. Blood being thus withdrawn from the general circulation there results considerable distension of the abdominal vessels governed by the splanchnics. This distension leads to congestion of the abdominal viscera.

Symptoms of shock due, for example, to a severe blow on the epigastrium may be thus explained as caused by a paralytic dilatation of the visceral arteries, which is attributed to an inhibitory influence upon the splanchnics, through the medium of a special reflex centre, which is in communication with the sensorium and all parts of the body. Physiologists have discovered that the stimulation of the central end of the divided portion of the depressor branch of the vagus leads to immediate lowering of blood-pressure in the head, neck, and limbs, this effect depending upon a dilatation of the abdominal arteries and consequent flow of blood towards the abdominal viscera.

Symptoms.—The patient is stunned, and his vital powers become blunted. This is generally the case where shock is the result of a severe accident or blow. When the shock is the result of mental terror or calamity, the patient suddenly becomes pale and faint; there is trembling of all the limbs; the extremities are cold and covered with clammy sweats; each side of the nose and forehead is bathed with beads of sweat; the pulse is weak and very frequent; there is great mental confusion. These symptoms are often met with in nervous patients on whom any operation is to be performed. Even the presence of the medical attendant is sufficient to give rise to them. These symptoms may pass off in a few minutes, but often they last for an hour or two. There is yet another class of cases where the symptoms are more marked. Immediately after an operation (even tapping of a hydrocele) the patient becomes stunned; he loses his consciousness; his senses become blunted; the skin of the face and of the limbs appears deadly pale, and is bathed with sweats; the face has lost its expression, and looks ghastly and anxious. These symptoms are often followed by irregular contractions of muscles of the body; the eyes are dull and motionless, and the pupils dilated; the pulse is very feeble, barely perceptible, and very rapid. The

temperature is usually one or two degrees lower than normal; the respiration is slow and gasping, the inspirations alternating with deep sighs. The patient may be conscious. There may be nausea and vomiting, and there is occasionally involuntary discharge of urine and fæces. In a majority of cases recovery follows in a few minutes or at most half an hour. The respiration, pulse, and temperature improve. The mental and physical equilibrium is restored. Vomiting occurs as a precursor of recovery. Where shock is the result of serious or extensive injury, or complicated with loss of blood, or lesion of some vital organs; when it occurs in nervous and weak individuals or in individuals suffering from heart or kidney disease the result is most unfavorable. It generally ends in fatal collapse. Cases are observed where, after an apparent improvement, relapses occur. Recovery is complete in cases of milder forms of shock. When the shock is due to a railway accident, there is often permanent derangement of health, or impairment of some of the special senses, or derangement of the mind or temper of the individual.

Diagnosis.—Shock is confounded with syncope or concussion, and it often coexists with both of these. Syncope, when alone, is generally transitory in duration, and its history bears reference to loss of blood. In concussion the marked peculiarity is the great disturbance of the mind as compared with that of the circulatory system.

When the temperature falls below 96° a fatal result may be expected. In many cases of shock, after a time, reaction sets in; the temperature rises, the skin becomes warm, and symptoms of restlessness and anxiety are soon very prominent. This form is common in cases of burns and scalds, in cholera, and in cases where the shock is due to injuries to important organs.

Treatment.—There are two main indications of treatment. 1. To sustain the lowered vitality, and 2, to moderate the reaction.

To restore the circulation of blood to the surface of the body we employ external warmth as hot bottles to the extremities, friction of ginger powder or of turpentine to the limbs, mustard plasters to the præcordia and to the calves, turpentine rubbed along the spine. If the patient cannot swallow milk and brandy, they may be injected into the rectum. Ammonia and ether may be injected hypodermically. The breathing, if very slow and laboured, may be assisted by artificial respiration, and even by electricity to the phrenic nerve. Venous congestion may be relieved by bleeding through the jugular vein. If the patient can swallow, nourishment and stimulants may be carefully given. Tincture of belladonna when given in ʒss doses stimulates the action of the heart, and also assists in contracting the paralysed arterioles. Calabar bean may be given with a view to lessen venous congestion by causing contraction of the veins. When the reaction sets in the patient should be supported, and hydrate of chloral, or hyoscyamus, or injection of morphia may be used with advantage. Ice to the head will often allay restlessness and excitement.

COMPLETE LOSS OF CONSCIOUSNESS.

Complete loss of consciousness may be due to a variety of causes. It is a regular occurrence in profound sleep (sopor), and in a sort of wakeful sleep, where a person after being roused again drops off and becomes unconscious (lethargy). Complete loss of consciousness also occurs from the use of anæsthetics. Cardiac syncope is characterised by a similar condition, due to a sudden cutting off of a proper supply of blood to the brain. Asphyxia is also a state of complete insensibility following upon interference with respiration. Narcotics of various kinds, as opium, alcohol, cannabis, and belladonna, produce extreme drowsiness and even profound insensibility. Retention of excrementitious products, as urea, bile, &c., in the blood, often lead to profound coma. Complete insensibility may also be noticed during the ordinary form of epileptic fit, or during an attack of convulsions. In cerebral apoplexy there is complete loss of consciousness lasting for some time. In cases of injury to the brain or concussion the loss of consciousness is not quite complete, and the condition known as stupor results. Such persons can be momentarily roused by loud speaking or violent shaking. When the insensibility is complete and absolute, and has a tendency to increase and assume a graver form, coma is said to result. Coma may be due to cerebral hæmorrhage (apoplexy). Persons attacked with sunstroke are often found in a state of coma. Coma may result from erysipelas of the head and face, from various poisons, as opium, alcohol, uræmia; from inflammation of the meninges. As an effect of a very high temperature, as 106° or 108°, coma often results. In coma, if the patient does not rally before the expiration of twenty-four hours, death inevitably results.

The various conditions which give rise to loss of consciousness may be thus formulated:

Apoplexy.—1. Loss of consciousness in severe forms, complete, and sensation entirely obliterated. 2. Reflex movements absent. 3. Breathing slow, loud, and stertorous. 4. Control over voluntary motion and sensation lost; the limbs can be pinched and conjunctivæ touched without any effect. Sphincters relaxed. 5. Pupils dilated; one or both insensible to light. 6. Temperature below normal; in advanced cases as high as 105°. 7. Paralysis—hemiplegia, present.

8. Vomiting rare. 9. Pulse slow and strong; often irregular. 10. Face pale; peculiar features. 11. Skin cold and perspiring. 12. Urine sometimes retained, sometimes escapes. 13. Direct evidence—mode of onset; hemiplegia. 14. Age, late in life. 15. Breath, nothing peculiar. 16. Intellect totally suspended. 17. Special senses—hearing, taste, sight and smell, &c., imperfect. Frequent ptosis.

Syncope.—The numbers refer to the same points as in Apoplexy. 1. Sudden and complete. 2. Unimpaired. 3. Quiet at first, then gasping. 4. Muscles relaxed. 5. Dilated. 6. Low, below normal. 7. None. 8. None. 9. Rapid or imperceptible, thready. 10. Pallid, blanched. 11. Cold, perspiring. 12. Normal or frequent. 13. Cardiac and venous murmurs. 14. Any age. 15. Nothing peculiar. 16. Suspended. 17. Impaired.

Asphyxia.—1. Complete. 2. Impaired. 3. Slow and feeble, often gasping. 4. Unaffected. 5. Contracted or irregular. 6. Lowered. 7. None; perhaps convulsions. 8. None. 9. Slow and feeble. 10. Turgid. 11. Cold; surface livid. 12. Normal. 13. None. 14. Any age. 15. Nothing peculiar. 16. Suspended. 17. Disturbed.

Narcotic—*Opium.*—1. Almost complete; can be roused with difficulty. 2. Abolished; involuntary passage of urine and fæces; muscles relaxed. 3. Frequent at first, later on superficial and slow. 4. Impaired. 5. Contracted; insensible to light. 6 Slightly lowered. 7. Convulsions sometimes. 8. Odour of opium in vomited matters. 9. Feeble, small, and irregular. 10. Pale, sometimes livid, shrunken. 11. Cold, often perspiring. 12. Suppressed. 13. History of opium. 14. Any period. 15. Smell of opium. 16. Impaired. 17. Impaired.

Alcohol.—1. Almost complete. 2. Suspended or partially impaired. 3. Slow, laboured, sometimes stertorous. 4. Irregular. 5. Dilated; contract under the influence of strong light, and again contract in darkness. 6. Much lowered. 7. Muscular relaxation; complete anæsthesia. 8. Smell of alcohol in vomited matters. 9. Frequent, small, and feeble. 10. Pale or congested, or florid. 11. Cold and perspiring, or dry. 12. Frequent and large quantity. 13. History of alcohol. 14. Any age. 15. Smell of alcohol. 16. Impaired. 17. Impaired.

Uræmia.—1. Complete. 2. Feeble. 3. Slow, laboured, and often stertorous. 4. Impaired or unaffected. 5. Dilated. 6. Lowered. 7. Epileptiform convulsions. 8. Common. 9. Slow and irregular, also feeble. 10. Pallid. 11. Cold and soft. 12. Albumen and casts in urine. 13. Kidney disease; anasarca. 14. Middle age. 15. Urinous odour. 16. Impaired. 17. Impaired.

Meningeal Hæmorrhage.—1. Complete. 2. Unimpaired. 3. Slow and stertorous. 4. Impaired; sphincters relaxed. 5. Irregular, insensible to light. 6. Irregular. 7. More or less general, associated with anæsthesia. 8. Usual. 9. Slow and irregular, often full. 10. Flushed or pale. 11. Normal. 12. No change. 13. History of congestion of the membranes or none at all. 14. Any. 15. Nothing peculiar. 16. Somewhat affected. 17. Impaired.

Sunstroke.—1. Complete. 2. Feeble. 3. Hurried, somewhat stertorous. 4. Muscular relaxation. 5. Contracted, insensible to light. 6. Very high, 107° to 109°. 7. Muscles relaxed. 8. Frequently associated with purging. 9. Slow and full at first, then later on rapid and feeble. 10. Red and flushed. 11. Harsh and hot. 12. High coloured, scanty. 13. Exposure to sun. 14. Middle age. 15. Hot. 16. Impaired. 17. Impaired.

Injury to the Brain. Concussion.—1. Intellect suspended. 2. Muscles weak and flaccid. Reflexes impaired. 3. Feeble, sighing, or almost extinct. 4. Sensation entirely lost. 5. Unequal, react feebly. 6. Below normal. 7. Muscles weak; bladder and sphincters paralysed. 8. Frequent. 9. Slow, feeble, and intermittent. 10. Very pallid. 11. Surface cold. 12. Urine passed involuntarily. 13. Injury. 14. Any age. 15. Nothing peculiar. 16. Suspended. 17. Act feebly.

Contusion.—1. Suspended. 2. Muscular rigidity. Reflexes impaired. 3. Slow but quiet. 4. Impaired; slight facial spasms. 5. Contracted, insensible to light. 6. Normal or slightly elevated. 7. Paralysis of eyelids. Sphincters relaxed. 8. Frequent. 9. Slow and feeble. 10. Pale. 11. Coldness of the face. 12. Generally retained. 13. Injury. 14. Any age. 15. Nothing peculiar. 16. Suspended. 17. Impaired.

Compression.—1. Suspended. 2. Reflexes abolished. 3. Slow, laboured, and stertorous. 4. Sphincters paralysed; retention of urine. 5. Dilated or unequal, insensible to light. 6. Variable, normal or increased. 7. Hemiplegia; deglutition difficult or impossible. 8. Vomiting sometimes occurs. 9. Slow, soft, and irregular. 10. Very pale. 11. Skin cold. 12. Bladder inactive. 13. Of injury, or extravasation of blood on the surface or into the substance of the brain. 14 and 15. Nothing definite. 16. Suspended. 17. In abeyance.

NERVOUS EXHAUSTION.

The term indicates functional disorder of the cerebro-spinal system, involving no structural lesion. It denotes weakness or debility of the nervous system, the brain being the portion most often affected.

Causes.—Nervous exhaustion most commonly occurs among those whose minds are occupied with tasks involving great responsibility, who are given to hard study, or who devote an undue proportion of their time to business affairs. Thus it is common among clergymen, lawyers, physicians, merchants, and speculators; cases of anæmia and of defective nutrition leading to general debility, are not to be regarded as instances of nervous exhaustion. Persons addicted to various excesses, as in venery, alcohol, and tobacco, and those who keep late hours often suffer from various forms of nervous exhaustion.

Symptoms.—Those whose mental occupations keep them indoors for several hours every day, who neglect out-of-door exercise, and other sources of recreation, suffer more than others. On the other hand, excessive mental work, when associated with due attention to the laws of health has been known to preserve mental vigour for a considerable length of time. When the condition is established, the patient complains of depression of spirits and a sense of fatigue towards evenings. The sleep is disturbed, and on waking he feels unrefreshed. He is irritable, and disposed to quarrel on the least provocation. He suffers from confusion of mind; he is bewildered and is unable to concentrate the attention. He loses all self-confidence in business or in his profession.

Treatment.—The treatment is both hygienic and therapeutic. The patient should be strongly impressed with the belief that in order to keep his body and mind in a normal condition, properly regulated exercise is peremptorily requisite for both of them. He should devote a certain portion of his time to outdoor exercise and to recreation; he should limit his hours for study or occupation or mental work. Complete cessation of mental work often does harm; change of work is often found to carry with it real rest. Alcohol is taken with benefit by some after a day's work; with the majority it does not agree, and its effect is temporary. Strong tea or coffee acts as a stimulant to the exhausted brain, and must be used with caution. Sleep should be restored by cold sponging or bathing before going to bed, by a healthful walk in the open air, or by a dose of hydrate of chloral, either alone or combined with bromide of potassium. Remedies that have special reference to this complaint are phosphorus and its preparations, *e.g.*, the hypophosphites till the patient is seldom free from the attacks. The noises in the ear or ears may vary from a mere buzzing or humming to a sudden explosion. Giddiness is very often followed by momentary faintness, palpitation of the heart, and signs of syncope. When the attack passes off recovery is often followed by vomiting. In such cases the patients are apprehensive of an attack of apoplexy, but there is no headache, the consciousness is retained throughout, there are no convulsions, no paralysis. When deafness becomes complete vertigo disappears. I have known of a case where the patient suffered from complete deafness, giddiness, and discharge from the internal ear. She was treated by a quack, who caused exudation within the semicircular canals by the application of a strong caustic to the external meatus, and thus injuriously stopped the discharge. This resulted in acute cerebral meningitis, and death within three days.

Treatment.—Where the affection is due to prolonged mental exertion rest to the mind will go a great way in relieving vertigo. As there is depression of vital powers tonics and stimulants are very useful. As vertigo may be due to cerebral congestion or to abuse of stimulants, alcohol, strong tea, or coffee, should be avoided. Quinine in large doses is very useful. It may be combined with other tonics. The patient should be well nourished, and any local affection must be treated and removed. Gastric and hepatic derangements should be carefully attended to. Chronic cases often require counter-irritation, as flying blisters behind the ears, or setons to the nape of the neck. For the attack in the aged, Liq. Hydrargyri Bichloridi is highly recommended. Bromide of potassium and also the iodide may be given in aural vertigo; under their use the deafness often becomes less, and the fits diminish in frequency and severity.

MENTAL DISEASE OR INSANITY.

Insanity is a nervous disorder, characterised by more or less marked or violent disturbances of the faculties of the mind. In every case it is associated with some derangement of the cerebral organs, and with some cerebral affections. It is known by various names. Some writers adopt the term insanity; others lunacy, unsoundness of mind, or mental derangement. The subject of insanity forms a separate branch of medicine, and usually receives less attention than it deserves in text-books of medicine in general.

However independent, in some of its functions, the mind may be of the body, it is certain that particular physical conditions are essential for the proper action of the mental faculties. Human

The inco-ordinate movements in locomotor ataxy, the oscillating movements in insular sclerosis, and the tremulousness in paralysis agitans, are often attended with vertigo. In many cases vertigo simply betokens general weakness, as in the early stage of convalescence from fevers and other acute diseases. Vertigo may be symptomatic of derangements of the stomach, liver, or intestines, or of kidney diseases attended with albuminuria, or of diseases of the heart. In females, prolonged lactation, and also menorrhagia, cause it. In old people, very often a diseased condition of the coats of the cerebral vessels leads to it.

Symptoms.—When it is a functional affection, it generally occurs in paroxysms. The sensation is often associated with derangement of the stomach. When due to this cause, it occurs in two forms. It may be slight and the patient only feels giddy, or may be severe and there is a reeling or staggering gait. In a still worse form the giddiness is so severe that the patient cannot stand on his legs, he falls to the ground if not supported, and there is loss of consciousness. It disappears in the recumbent posture, and returns if the head is raised. The paroxysms are often accompanied with nausea and vomiting. They occur frequently, and are worse after fasting, and relieved by moderate meals. In the intervals there is a great depression of vital powers, and the patient is extremely anxious. Physiologically considered, the semicircular canals are concerned in perfect hearing and in keeping the equilibrium in standing or any movement of the body or of the head; any injury or disease of these organs gives rise to impairment or loss of hearing, and to vertigo or swimming in the head. It has been experimentally observed that injury to the horizontal portion of the canals leads to rotation of the head from side to side; injury to the superior canal causes the head to move upwards and downwards, and to fall forwards; injury to the posterior canal causes the head to fall backwards, and also moves upwards and downwards. In otitis interna and in diseases of the middle ear, the inflammation sometimes leads to exudations, which, pressing on the contents of the labyrinth, extend their influence to the semicircular canals, and thus giddiness with sudden deafness results. In a vast majority of cases without any otitis or any other cause, the patient is suddenly seized with noises in one ear or in both ears, and there is a fit of vertigo, followed by faintness or pallor of the face, with perspiration, nausea, and even vomiting.

Duration.—The fits last for a few seconds or for a long time. In the interval the patient feels apparently well.

Relapses.—At first the attacks recur at long intervals, but sooner or later the intervals become shorter and the exacerbations longer till the patient is seldom free from the attacks. The noises in the ear or ears may vary from a mere buzzing or humming to a sudden explosion. Giddiness is very often followed by momentary faintness, palpitation of the heart, and signs of syncope. When the attack passes off recovery is often followed by vomiting. In such cases the patients are apprehensive of an attack of apoplexy, but there is no headache, the consciousness is retained throughout, there are no convulsions, no paralysis. When deafness becomes complete vertigo disappears. I have known of a case where the patient suffered from complete deafness, giddiness, and discharge from the internal ear. She was treated by a quack, who caused exudation within the semicircular canals by the application of a strong caustic to the external meatus, and thus injuriously stopped the discharge. This resulted in acute cerebral meningitis, and death within three days.

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However independent, in some of its functions, the mind may be of the body, it is certain that particular physical conditions are essential for the proper action of the mental faculties. Human beings may occasionally overcome these physical necessities, but, if so, with an extraordinary loss of tissue. The lines of Dryden exactly express the nature of the process when the powers of the mind and of the body do not work together.

> "*A fiery soul that, working out its way,*
> *Fretted the pigmy body to decay.*"

A sufficient flow of oxygenated blood, a proper nutriment, and normal temperature, sufficient light, sufficient sleep, these are essential for the preservation of the mind in its normal condition. None of these can be long withdrawn without danger to it.

Definition.—Insanity or unsoundness of mind may be defined to be a state in which there is a want of balance of the powers of the mind. There may be diversities as regards the faculties of the mind; some faculties may be present in excess, and some may be absent altogether. Thus, a human being may be almost mindless, or may have his mind active beyond reason in a particular direction. To draw the exact line between insanity and mere exaltation is very difficult.

> "*Great wits are sure to madness near allied,*
> *And thin partitions do their bounds divide.*"

The English law recognises the difficulty and is exceedingly vague in its definition of insanity, leaving the point to be determined in each particular case. Practically, a certain range of eccentricity is recognised as within the limits of sanity. Any deviation beyond those limits is called insanity. In doubtful cases, insanity may be determined by the continued exercise of observation and the knowledge of human nature in general, assisted by practical experience and skilled investigation of the patient's actions and dealings at the time, which show that the limits of sanity are exceeded. A decided change in the patient's ordinary habits and modes of acting is often an indication of mental derangement.

Symptoms.—A great variety of phenomena as delusions of every description, exalted and depressing, may be observed, or the patient may have a tendency to a particular line of crime, as homicide or suicide. The symptoms of insanity begin in various ways; sometimes their onset is gradual; sometimes the patient appears to become insane in a single attack of acute mania; sometimes the attack follows parturition; sometimes it is associated with the onset of acute fever, or of a chronic disease, such as phthisis. That the patient is insane can be made out chiefly from his conversation and conduct. His general bearing and manner and his facial expression are often peculiar and diagnostic. Special psychical symptoms consist of hallucinations, illusion, delusions, and incoherence.

Hallucinations indicate disorder of the perceptive faculties of the mind. There is a false perception, but no external cause for any sensory impression. The person sees things which have no real existence, or hears sounds which are not heard by others.

Illusion is a term which denotes somewhat similar mental aberration. In it the person sees shadows of objects, as fantastic shapes of men or beasts. In illusion there is a false perception of a material object, and it may occur in connection with any of the senses.

In a *delusion* there is a false belief on the part of the patient, of the falsity of which he cannot be convinced. He firmly believes his perception or belief to be true. There is derangement of the reasoning powers and of the understanding. He may, for instance, have a belief in the existence of conspiracies to do him harm, or that he has been ordered never to taste flesh, there being no foundation for such beliefs.

Incoherence signifies a rapid succession of ideas without any order or connection. These are the chief features of insanity. The disorders of emotion, intellect, and will are generally found associated in every possible variety, and they give rise to the conditions described as mania, dementia, and amentia respectively. They all involve perversion of the mind.

Mania.—In mania, excitement is predominant; in dementia, depression; and in amentia, simple weakness or impairment or loss of the powers of the mind. Mania is a form of insanity in which the mind is perverted; the perceptive, intellectual, and emotional faculties are in an excited state. The patient cannot reason or give attention to what is told him. There is absence of any link in the flow of ideas. He has no power to control or regulate his mental acts. The hallucinations, illusions, or delusions are all variable and transitory. Mania occurs in two forms, acute and chronic. In the acute variety the patient is wild, or raging mad. He has a peculiar expression, is violent and furious or excessively angry. He has lost his power of self-control, and attempts to hurt those within his grasp. There are other manifestations of acute mania, as boisterous laughter, violent outcries, abusive language, &c. The patient breaks or destroys furniture, or tears clothes, is abusive to all near him, and to his relatives and friends, and he is devoid of any sense of right or decency. He is indifferent as to his habits and conversation. a marked change in this respect, as compared with his previous state, being often noticed. The disease is often preceded by a period of deep mental depression or melancholia.

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In some cases the patient passes sleepless nights before the attack comes on. During the fit the sleep is often disturbed; or the patient does not sleep at all for several successive days and nights, and there is constant excitement of the mind, with great physical activity. The pulse notwithstanding keeps quiet, and is but little increased in frequency. The temperature continues normal or is slightly increased. The appetite is voracious, and the digestion good. In a few cases fever sets in. Where mania is long-continued the disease becomes chronic, and there are frequent paroxysms of mental excitement brought on by the least provocation. In many cases the mental activity is aroused spontaneously or without obvious cause.

Termination.—Dementia is the most frequent termination of mania.

Diagnosis.—Mania may be confounded with active delirium, or with delirium tremens. Active delirium is a symptom of acute cerebral meningitis and of hyperæmia of the brain. In delirium tremens there will be a history of alcoholic excesses and other symptoms of a peculiar character. It may also be mistaken for the delirium of essential fevers and acute inflammation. High temperature excludes mania. Mania is subdivided into monomania, melancholia, and impulsive insanity.

Monomania.—It denotes an insanity which is indicated by some one particular fixed and persistent delusion, the mind being clear on every other point. Various writers on forensic medicine dispute the definition of monomania. Some mean by it an insanity without delusion, and call it impulsive insanity. Others suppose it to be disorder of ratiocination, confined to a few subjects, with excitement and exaltation of the passions. A monomaniac evidently suffers from a partial insanity, although his actions and conversation are rational to a great degree. The delusions of monomaniacs involve hallucinations, chiefly relating to the senses of sight and hearing. Thus they sometimes have visions of supernatural beings. They hear voices which have no existence. They are often governed or commanded by imaginary beings; such commands may lead to homicide or suicide.

The delusions may be simple and unassociated with illusions or hallucinations. Thus, monomaniacs often imagine themselves some one of the inferior beings, or that they are made of glass, &c. Sometimes they believe themselves to be illustrious personages. The delusions may relate to wealth, or to various personal circumstances in life. Monomaniacs, although poor and penniless, may indulge in immense expenses, incur debts, and promise large fortunes.

The delusions often lead such persons to believe that they must destroy their children in order to escape the trials of this life; that they should commit suicide in order that they may rejoin their dead friends. The act is never deliberately committed.

Melancholia.—It is a form of insanity in which the patient has extravagant delusions of a melancholy character. The condition of mind is one of intense anguish or despair. The mental distress is great. There is perversion of sentiment, intellect, and will, associated with depression. Such patients are generally quiet, apathetic, and often live alone without society or friends, and remain for hours in any position in which they may place themselves. There is no weakness nor decay of the mental faculties as we find in dementia. Where the delusion relates to a fanciful disease of the body, it constitutes hypochondriacal melancholia, and such patients are especially apt to commit suicide. Frequently, however, delusions have reference to the moral or spiritual condition, and the patient imagines that he has committed unpardonable sin. It is then known as religious melancholia. Hysterical patients often show signs of melancholia, but in them there are other symptoms of hysteria associated with the affection which is only of a temporary character.

Emotional insanity.—It is otherwise known as impulsive insanity. It implies acts of violence to which the patient is driven by some blind, uncontrollable impulse; the will and reasoning are quite in abeyance for a longer or shorter time. In this insanity there are no delusions. The patient may attempt to commit suicide or a homicidal act, and, after such attempts, he would find the impulse satisfied and his brain so far relieved. Such persons are incapable of forming correct judgment; their will is powerless in the presence of the impulse, and they feel no remorse for the impulsive acts of violence they commit. They may exhibit a propensity to burn buildings (pyromania); to steal (kleptomania); to sexual intercourse (erotomania); to alcoholic excesses (dipsomania). Satyriasis and nymphomania are other forms of impulsive insanity.

Dementia is another variety of insanity, and may be defined to be madness without incoherence, or mental weakness or deficiency rather than aberration of intellect. It may be acute or chronic; may follow mania or its subdivisions, or come on in old age (senile dementia). Sunstroke is often said to cause it. It is sometimes a consequence of apoplexy and epilepsy; the mind remains confused and dull after an attack of either of these affections. In chronic cases the expression of the face is meaningless, and there is a vacant smile. The memory is impaired, and the manners are childish. The patient often becomes paralytic.

The delirium of typhus fever may often be compared to dementia; that of typhoid to mania. In pronounced cases the impairment or feebleness of the mind is such that the mental powers are but little superior to those of the brute creation. The physical condition largely corresponds with the mental. The heart's action is much reduced in strength, the circulation is languid, and the extremities are cold and bluish. The pupils are dilated, and the tongue is pale and flabby. Bronchitis is apt to supervene; and these patients require warm coverings, external warmth, and good food. Females form the more numerous class of patients suffering from dementia.

Idiocy.—It is a congenital deficiency of the mental powers. In this form the mind is nearly wanting. Consciousness and power of voluntary movements are very defective. The intelligence is least developed. Idiocy exists in every degree, from mere defect of some one faculty to almost complete absence of all. Thus, there are idiots whose only faculty is a notion of time. This may be remarkably accurate. One such idiot having, on his admission into an asylum, had his nails and hair cut at 10.45 a.m., came every day at precisely that hour, holding out his hands and bending his head for the repetition of the operation. He was, of course, unable to read the clock. As an example of idiocy in which a particular faculty only was defective the following case may be mentioned. One who was able to do long multiplication sums in his head, but when asked how many apples at a pie each could be got for an anna (equal to twelve pice), said one apple for one pie, four pice make one anna; how many apples is that for one anna? And after repeating this many times he was unable to get any further, and finally shook his head, saying, "I can do sums, but never was good at puzzles." The elaborate education of idiots has brought out more and more this broad fact, that it is only a little piece of mind, so to speak, which is absent in many cases.

Cause.—Consanguineous marriages of families which are tainted by insanity, or have deaf and dumb members, or are scrofulous, are the chief cause of idiocy. Too early closure of the cranial bones appears in some cases to prevent the proper development of the brain, and the head is small. The same result is produced, though not in every case, by congenital hydrocephalus.

Symptoms.—A vacant expression, a loud laugh, a shambling gait, dribbling from the mouth, an ill-shaped head, and dirty habits are the symptoms of idiocy. Such children are slow in learning to walk and in acquiring speech.

Diagnosis.—The most important point is the determination of whether the child will be an idiot or not. A good general rule is that, if a child of the age of five years can hear and cannot talk, though its vocal organs are complete, it is an idiot.

Imbecility.—Cases of imbecility are among the most difficult of all to define. The defect of faculty is sometimes moral and sometimes intellectual, and is noticed during infancy, or as the patient grows up, or when he is grown up. Once established the condition closely resembles idiocy. The patients are known as half-witted, feeble-minded persons.

Diagnosis. — Great perverseness, inability to harm anything, peculiar eccentricities, are the points which lead to diagnosis.

These cases require careful management, and continued but gentle control. It is often a difficulty to find sufficient grounds for a certificate of insanity, or of incapacity to manage their own affairs, or to take care of property.

Cretinism is a form of hereditary and congenital insanity met with endemically in some mountain valleys, especially in those of Switzerland. Its chief peculiarity is that it is associated with goître, that is to say, in such districts some members of a family are cretins and suffer from goîtres. The thyroid bodies of the cretins are sometimes of the normal size. In other respects cretinism does not differ from imbecility. The cretins are dwarfish, deformed beings, and more or less imbecile.

Treatment.—The treatment of insanity can, of course, be pursued only in proper asylums. The sooner insanity is treated the better for the patient. The advice of a person with special experience should be sought, and an impending attack may sometimes be warded off by change of scene and rest from work, with strict attention to hygienic laws and careful observation. In many cases the patient need not be placed in an asylum. Other cases, particularly those of a suicidal or a homicidal nature, ought at once to be placed in an asylum. Friends often say that the patient will be driven quite mad by being placed in an asylum; this is a mistake. Patients, as a rule, who are mad enough to require to be placed in an asylum, probably hate restraint as much when it is exercised at home as in an institution. Melancholic patients do not become any less melancholic for staying at home. In every case the patient should be removed from his associates. He should be taken away from causes which might excite him; protected against self-injury as well as prevented from hurting others.

In the early stage the attention should be directed towards preventing the causes, both moral and physical, and, if possible, towards their timely removal. Diseases of the generative organs in women is a fertile source of insanity, and should therefore be carefully treated. Excesses of any kind, both bodily and mental, are productive causes of insanity. Sexual and alcoholic excesses are especially mischievous, and should be firmly interdicted.

When *acute mania* breaks out it may be only of a brief duration, and therefore may be treated at home, if circumstances are favorable. Removal to an asylum is appropriate if the disease tends to continue or recur after very short intervals. In acute cases the chief aim in the treatment is to procure sleep. For this purpose opium and various antispasmodics are highly beneficial. Inhalation of chloroform and chloral hydrate internally are useful. Chronic cases should always be treated in an asylum.

Monomania.—If there be associated delusions of a destructive character, the patient should be removed to an asylum; but if otherwise, or the delusions are harmless in character, mental occupation and diversion from objects relating to the delusions are the proper mode of treatment.

Melancholia.—Melancholic patients require proper attendance and change of scene. Mental occupation is an important object. Any coexisting physical disease should be treated. Constipation generally exists and aggravates all the symptoms. It should be relieved by purgatives; a combination of aloes with extract of belladonna and quinine is very suitable.

Impulsive insanity.—The affection may sometimes be arrested by relieving any coexisting physical disease, and improving the general health. Recreation and change of scene are the most useful measures indicated. If, notwithstanding these measures, destructive impulses are observed, the patient should be sent to an asylum.

Dementia.—It may be prevented or retarded by improving the mental condition by judicious and regulated exercise of the different functions of the mind. Occupation, both physical and mental, within due limits, is highly beneficial.

HYPOCHONDRIASIS.

It is a mental disorder. In it, the mind of the individual is oppressed by a painful impression. He is plagued with the idea that he is sick with a certain complaint, or that he is going to be sick. Mere idea of being sick is not to be regarded as hypochondriasis. To constitute the true disease the impression alone should form a symptom of disease.

The affection is supposed to be due to nutritive changes in those portions of the brain where psychical actions reside; but what the nutritive disorders may be is not clear. There is no lesion of the brain to account for this morbid state of the mind. Where the predisposition exists, hypochondriasis may develop either from psychical or physical influences.

Causes.—The disease can often be traced to some known cause. The predisposition is greater in males than in females, and the affection is most common between twenty-five and forty years of age. Females sometimes suffer from it at the decline of life. In a few cases it can be traced to hereditary influence. Various debilitating influences, as sad news, disappointments, as in love; loss of property, position, or character; disorders of digestion, alcoholism; various excesses, as in venery, masturbation; sedentary habits, want of fresh air, want of occupation, predispose to it. Bachelors, persons of fortune with no pursuits in life, and those given to pleasures form a class liable to suffer from hypochondriasis. The exciting causes are disorders of digestion, and chiefly the chronic gastric catarrh, diseases of the genitals, gonorrhœa, and syphilis. In all these cases a certain mental impression is the most potent source of the symptoms.

The tendency to melancholia may be acquired. In persons with excessive sensitiveness of mind there is often an inability to repress thoughts or feelings which another with mental quietude deems unworthy to express. Persons engaged in laborious occupations during youth, if during old age they relinquish the habit of mental activity, often become hypochondriacal. The disease affects persons who from morning till night go through severe mental exercise without even a shadow of recreation or any diversion. The disease prevails chiefly among the more educated and well-to-do classes. A hypochondriac should always be kept apart from another with a similar tendency. He may not harm the majority of people, but might cause similar symptoms where any propensity exists.

Symptoms.—They all indicate excessive action of the imagination. The patient exaggerates the descriptions of his sufferings. He believes his sickness to be infinitely severe. In spite of these imaginary symptoms he by no means despairs of recovery. The disease is progressive. At first the patient experiences infinite suffering, which causes him deep annoyance and distress. He feels very much oppressed and distracted, and is generally restless. At the commencement his judgment and mental control are not disturbed. In advanced cases he loses all interest in matters in which previously he was deeply concerned. At times he is free from all imaginary symptoms. When they recur they appear in increased severity. The patient is anxious to trace the cause of his illness.

Any slight irregularity is construed by him into a serious malady, of a character corresponding to his imaginary sensations of distress and suffering. Any time or trouble taken to convince him that his apprehensions are false, or that his condition of body is such that there is no danger, is spent in vain, as it cannot relieve him of his feelings. He consults every medical man within his reach, but in none can he confidently rely; he only sticks to a belief that his suffering is of a grave character, and he cannot be dissuaded from it. From every new adviser, after a moderate course of treatment, he finds some relief; but if the treatment be pushed for some time he finds himself and his old complaint in the same distressful condition as before, and he often imagines that some new disease has been superadded. A very slight coating on the tongue, a change in the condition of his stools, or of his urine, is taken by him as indicating the most serious derangement. He counts his pulse and notes his temperature to confirm his belief that he is dying from fever. If he has a slight cough he conceives himself to be suffering from consumption; a slight colicky pain is construed into a grave intestinal disorder. He imagines a painful sensation in the epigastrium to be due to an ulcer of the stomach. If he is full and plethoric he imagines that he will die from apoplexy. A slight irregularity or painful sensation in the cardiac region is regarded as indicating heart disease. Any little painful sensation in the hypochondrium is construed into a symptom of hepatic abscess. He indulges in reading medical literature, and applies the description of every disease to himself. He is of opinion that the doctor always makes light of his case, and therefore, to get the better of his medical adviser, he always gives long descriptions of his ailments. Hypochondriacs often have peculiar delusions and hallucinations respecting the condition of their own bodies. They often falsely imagine that their right limb is extremely thin, and the skin over it withered up. Some hypochondriacs become so confirmed in their ideas and fancies that they become abstracted and forgetful. Many of them lead a dull life, and even remain closely confined to bed for years. Gradually they lose flesh and strength, get emaciated, their appetite becomes deranged, and the secretions perverted. The derangement of nutrition and the emaciation are supposed to be due to cachexia, brought on by depressed mental faculties, with which the functions of various organs sympathise.

Treatment.—In melancholia the treatment is chiefly mental. The patient should be warned of the advantages of early rising, of exercise in the open air, of mental occupation, and agreeable companions. Invigoration of the body by attention to hygiene and proper sanitation is never to be neglected. Any functional disturbance noted should be carefully watched and guarded against. It is always a pernicious practice to resort to drastic purgatives and various carminatives, or to alcohol and opium as palliatives in these cases. The chief hope of the cure of a hypochondriac lies in securing his full confidence. This can only be gained by those whose opinions are regarded as authoritative. When called to treat a hypochondriac, however exaggerated the description of symptoms may appear, the physician ought to show a proper amount of interest and sympathy in the case. The patient may thus understand that his case has received a due amount of attention, and that his adviser is fully competent to cure him. As most hypochondriacs suffer from gastric derangements, various natural waters are often prescribed with benefit. Sea-bathing and mustard foot-baths are equally to be recommended. Change of scene to some agreeable locality is very conducive to recovery. Pleasant occupation and society will often help to cure the disease. It must not be forgotten that hypochondriasis sometimes passes into real melancholia.

DISEASES OF THE RESPIRATORY ORGANS.

AFFECTIONS OF THE NOSE.

CATARRH OF THE NASAL MUCOUS MEMBRANE.

Nasal catarrh or coryza is a catarrhal inflammation of the mucous membrane of the nasal cavities, sometimes extending to the frontal and sphenoidal sinuses, and even to the pharynx and larynx.

Causes.—Draughts of cold air on the back of the neck, wet feet, or sudden changes of temperature are its causes. It may occur as a symptom of influenza, measles, &c.

Pathology.—It is said to be due to some specific animal poison which, circulating in the blood, manifests its effects in the nose and other respiratory organs by irritating them by its presence, or by producing irritation of these organs during its elimination. When the patient is exposed to cold the function of the skin is impeded, the cutaneous excretion is thrown back into the blood, and induces thereby a condition of toxæmia. This state of blood-poisoning is corrected by the elimination taking place through the nasal mucous membrane.

Symptoms.—These are languor, lassitude, depression of spirits, a feeling of tightness across the forehead, dryness, followed by profuse discharge from the nose and eyes, hoarseness of voice, sore throat and feverishness. In some cases an eruption of herpes appears about the middle of the upper lip. In mild cases the symptoms begin to subside in two or three days; in formidable cases they pass into acute tonsillitis, bronchitis, or pneumonia, when the febrile symptoms become more marked and are attended with irritating cough. If the trachea is also implicated in the catarrhal inflammation, we have dyspnœa, and the patient feels great uneasiness on coughing and pain behind the sternum.

Treatment.—The complaint is generally slight and mild; an aperient and a mild diaphoretic and putting the feet in warm water shorten the duration of the symptoms. Some recommend hot vapour inhalation or iodine-vapour inhalation; others apply extract of opium to the forehead and nose with success. To take no liquid of any kind for twenty-four or forty-eight hours is an effectual remedy; but few persons care to submit themselves to this regimen. To remain in bed in a warm room for thirty-six hours is often the best way to cut short a cold, and a few grains of Dover's powder will relieve much of the discomfort. Persons subject to nasal catarrh should wear flannel next the skin and should use a tepid or cold sponge-bath daily.

OZÆNA.

In scrofulous and syphilitic cases, the nasal catarrh is sometimes chronic, the mucous membrane is thick and œdematous, and the secretion forms thick crusts, which give rise to a fœtid smell on sneezing or on their discharge.

In ozæna the smell resembles rotten eggs and causes great disgust to the patient himself. Such patients generally sleep with their mouths open and snore heavily at night. In many cases the voice becomes weak and feeble. The disease may end in necrosis of the septum of the nose or of the spongy bones. In some cases a foreign body or a polypus gives rise to it. In scrofulous cases the odour is supposed to be due to the formation of butyric acid. In ozæna due to syphilis, gummatous deposits and subsequent deep-seated ulceration are the cause of the condition and the odour.

Symptoms.—These vary with the cause. The patient, after undue exposure to cold, complains of great uneasiness in the nose owing to the thickening of the mucous membrane, thus preventing the passage of air; of frontal headache; general weakness, some amount of deafness, and mental depression. With these a profuse muco-purulent or sanious discharge takes place or large solid flakes of fibrin come away. The smell from these decomposed crusts is very offensive. As the case progresses the patient becomes more despondent and miserable, loses flesh and strength, and if the septum of the nose or the spongy bones become implicated, troublesome caries or necrosis follows. Even if the disease is confined to the mucous membrane, it is often very intractable and chronic in character.

Treatment.—Local and constitutional. Local, as the fœtor results from the decomposition of retained crusts, &c., the nostrils should be frequently washed out with a tepid solution of borax and glycerine, and the inspissated matters dislodged. A stimulant and antiseptic snuff composed of Borax ʒj, Bismuth. Nitrat. ʒj, Quiniæ Sulph. gr. x, Iodoform gr. v, will remove the fœtor and diminish the nasal discharge. If due to small mucous polypi, the secretion should be moderated by such remedies as destroy them or act as astringents. The acid nitrate of mercury, trisnitrate of bismuth, or the red oxide of mercury with sugar, may be used with advantage. Constitutionally, nourishing diet, improvement of digestive organs, and tonics may be needful. In strumous cases notes. In normal speech the true vocal cords approach one another in their whole length, and are in almost absolute contact so as to project into the larynx as vibrating membranes. The expiratory current throws them into vibration, and their tension gives rise to a pitch of tone. The different notes which the same voice utters depend upon variations in the rate of vibration of the vocal cords. Speech then consists of two factors, phonation and articulate sounds. In order that the phonation may be normal, the cords should be (1) of normal *texture* and thickness; (2) they should *vibrate easily;* (3) the *tension* of the cords should also be normal; and (4) the cords should come into almost *complete contact* with each other. Any deficiency in one or other of these four conditions leads to various changes in the voice and speech. In acute laryngitis the voice is hoarse, cracked, whispering, or altogether lost. In laryngeal phthisis it is harsh or in a loud whisper as if coming from the roof of the mouth. In syphilitic laryngitis it is coarse, and often whistling. Even in slight inflammation of the larynx the voice is hoarse and husky. In ulcerations, thickenings, and in morbid growths in the larynx the voice is cracked and husky. In chronic laryngitis there is dysphonia or aphonia.

Aphonia, or loss of voice.—The term means absence of voice. In it the voice is reduced to a whisper. It is caused by failure of the cords to approximate, as in hysteria and other functional disorders, as derangement of the uterine functions, and irritation of the ovaries. In conditions of great exhaustion, aphonia is due to failure of sufficient current of air. It may be produced by emotional causes or by nervous shocks. Lead, oxalic acid, and arsenic poisoning have the same effect. Syphilitic or other adventitious growths on the vocal cords lead to it. Aphonia, or loss of voice without alteration of quality, is rare. Hoarseness of voice, the quality being altered, is an extremely common symptom in laryngeal diseases. Hoarseness is of two kinds. It may be permanent, and the voice is replaced by a prolonged whisper; or it may be transient, the voice being mainly hoarse, but with intervals of normal voice-sound, or of phonation and articulation. It may be functional or due to structural changes in the larynx or the glottis. When due to nervous shock it is transient, and only lasts for a few days. Occasionally in hemiplegia the movements of the cords are not properly performed, and the voice is weak.

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Articulate sounds, which by their combinations make words and sentences, are produced by the passage of expired air through the vibrating glottis. Their several specific characters are due to the fact that the expired air, in its transit from the rima glottidis to the external air, is checked by obstructions of different kinds, and made to pass through varying channels, and thus the oral sounds are superadded to those of the laryngeal voice. Articulation may be performed in many ways; even patients in whom the tongue has been removed can talk almost perfectly. The power of articulation is chiefly lost in bulbar or labio-glosso-laryngeal paralysis. In it the patient utters monotonous inarticulate sounds. Modifications of the voice in disease are sometimes of diagnostic importance. In cerebral affections in children the cry is sharp, short, and sudden. In abdominal diseases attended with pain the cry is prolonged. In inflammatory diseases of the lungs and in rickets the child is very quiet on account of the interference with the respiratory functions.

Stammering.—This disorder commonly occurs in childhood, but is rare in adults. It is characterised by a sudden hitch in the act of speaking; there is an arrest in the flow of labial, lingual, or guttural sounds. With regard to the localization of the defect or the place where the hitch occurs in the articulatory faculty, the word *booby* tests the utterance of a labial sound. In stammerers the mouth becomes spasmodically closed, and the labial sounds are produce tension of the cords. The lateral crico-arytenoid muscles, or the adductors, bring the arytenoid cartilages together, and thus help in closing the glottis. The thyro-arytenoid, or the relaxers, run parallel to the cords, and their action tends to relax them.

All these muscles are supplied by the branches of the vagus, the crico-thyroid by the superior laryngeal nerve, and the posterior crico-arytenoid and the lateral crico-arytenoid by the recurrent laryngeal nerve. During health these muscles open and close the glottis under the influence of the recurrent nerve. How these diametrically opposed functions are performed by the same nerve is not clearly understood. Some believe that the nerve is a homogeneous one, that the fibres are all identical, and that different stimuli coming from different centres can set up in its root different forces, which are conducted through all the nerve fibres, acting at one time on one set of muscles, and thus opening the glottis, and at another on the antagonists, or closing the glottis. Others are of opinion that the recurrent nerve consists of a bundle of different fibres, only bound together by a common nerve-sheath, each individual fibre throughout its periphery having a distinct ganglionic centre of its own. If the first hypothesis be true, any lesion affecting the roots or trunk of the spinal accessory, the pneumogastric, or the recurrent nerve, should lead to diminution of motor function of all the laryngeal muscles, and there should be paralysis of both the adductors and the abductors. But such is never the case in practice, for we always find in lesions involving the trunk of the nerve one set of muscles exclusively paralysed, though in the further progress the other set of antagonistic muscles may become involved. If the latter hypothesis be correct, it must follow that in any intrinsic nerve disease, or lesion affecting the nerve trunk externally, and lesions of the nerve from its centre to the spot where it gives off the first branch, should lead to impaired activity of all the laryngeal muscles; and similarly in paralysis of a single laryngeal muscle, or of a set of muscles, the lesion, if not due to any mechanical cause, must be due to injury or disease of a corresponding single peripheral nerve-fibre.

We know for a fact that laryngeal paralysis is often restricted either to the abductors or the adductors. Whether such paralysis may be due to lesions in the nerve-centre or in the main trunk is not conclusively decided. Cases are known in which, during life, paralysis of one or both the abductors was observed, and after death lesion of the recurrent nerve-trunk was found. Where the lesion affects all fibres of the nerve the trophic changes are observed in all the muscles supplied by that nerve. It is an undeniable fact that in cases of paralysis affecting the vocal cords the lesion or the original morbid change which leads to it is found in the cerebral centre.

Where the lesion of the recurrent nerve is complete there is total loss of function of all the laryngeal muscles with the exception of the crico-thyroid. This occurs in cases of injury to the trunk, or where, by the influence of some poison, or by the occurrence of hæmorrhage in the floor of the fourth ventricle, the trunk is affected at its origin. Such cases are very rare. Cases occurring in every day practice are those where the lesion is incomplete, and the paralysis gradually progressing. In such cases the paralysis may be due to lesions involving the trunk of the pneumogastric and spinal accessory; to cerebral disease involving lesions of the medulla oblongata, as progressive bulbar paralysis; disseminated cerebro-spinal sclerosis, and locomotor ataxy. Paralysis is common in cases of tumours or aneurisms within the skull pressing on the spinal accessory nerve. Tumours in the neck, such as aneurisms of the carotids, goîtres, cancer, syphilitic gummata or mediastinal tumours pressing on the trunk of the pneumogastric nerve; tumours or growths pressing on the œsophagus, and the recurrent laryngeal all lead in a slow and progressive manner to lesion of motor innervation of the larynx, whether they press on a large trunk or a small nerve belonging to the trunk. In phthisis pulmonalis the pleuritic adhesions affecting the right recurrent nerve at the apex of the right lung sometimes lead to paralysis of the larynx. It is thus that incomplete or slowly progressive paralysis depends upon the lesion of fibres which may be at first accidentally affected, and we may also expect lesion of the abductors in one case and of the adductors in the other. Bearing on this view, we find that cases of bilateral paralyses of the abductors are due to lesion in the brain or the nerve trunk, and not in the nerve-fibres.

The voice and speech.—Talking or ordinary conversation implies three distinct things: voice, articulation, and speech. Voice is an emission of breath-sounds, due to normal action of the lungs and respiratory apparatus, and is of fundamental importance in the production of both laryngeal and oral sounds. Articulation implies words which express our thoughts. They flow themselves without any attention being paid to their utterance, and are the result of the movements of the jaws, lips, cheeks, tongue, and soft palate. Speech consists in the perfect production of elementary articulate sounds and of moulding of the sound into words. It has its source in that part of the brain in which the ideas are transformed into words and revived into thoughts and acts. The passage of air through the laryngeal apparatus gives rise to different musical notes. In normal speech the true vocal cords approach one another in their whole length, and are in almost absolute contact so as to project into the larynx as vibrating membranes. The expiratory current throws them into vibration, and their tension gives rise to a pitch of tone. The different notes which the same voice utters depend upon variations in the rate of vibration of the vocal cords. Speech then consists of two factors, phonation and articulate sounds. In order that the phonation may be normal, the cords should be (1) of normal *texture* and thickness; (2) they should *vibrate easily;* (3) the *tension* of the cords should also be normal; and (4) the cords should come into almost *complete contact* with each other. Any deficiency in one or other of these four conditions leads to various changes in the voice and speech. In acute laryngitis the voice is hoarse, cracked, whispering, or altogether lost. In laryngeal phthisis it is harsh or in a loud whisper as if coming from the roof of the mouth. In syphilitic laryngitis it is coarse, and often whistling. Even in slight inflammation of the larynx the voice is hoarse and husky. In ulcerations, thickenings, and in morbid growths in the larynx the voice is cracked and husky. In chronic laryngitis there is dysphonia or aphonia.

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DYSPHONIA (CLERGYMAN'S SORE THROAT).

This word literally means difficult or painful voice; the most common example of the complaint is what is called dysphonia clericorum. In it the character of the voice is changed.

Causes.—It may originate in catarrh of the larynx, and may be the result of over-exertion or of persistent use of the voice.

It occurs in clergymen, barristers, singers, public speakers, and actors. The disease may be idiopathic and exist alone, or may be secondary and follow inflammation of the larynx, and of bronchi and phthisis. In this affection there is a special tendency to hypertrophy of the laryngeal glands.

Pathology.—It is a chronic affection, due to a follicular disease, and consists in an irritable condition of the lining membrane of the fauces and of the larynx. In severe cases a series of morbid changes take place, as congestion, inflammation, or relaxation of the mucous membrane of the fauces, enlargement of the tonsils, elongation of the uvula, or inflammation, ulceration, or morbid deposits in the mucous follicles of the pharynx and larynx.

Symptoms are those of chronic laryngitis, but more mild. The patient complains of an uneasy sensation in the throat and frequent desire to swallow, as if there were some obstacle in the throat which can be removed by deglutition. He also attempts to clear the throat by coughing or hawking, and points to the throat as the seat of pain and uneasiness. These symptoms are soon followed by loss of power over the voice, which is chiefly felt towards evening.

Physical signs.—On examining the throat by the laryngoscope we find the mucous membrane presenting a granular appearance, and covered with a yellowish substance, and mucus and pus adhering to the palate, and also to the velum palati.

Treatment.—In the early stage, tonics, shower baths, sea-bathing, change of air, and moderate occupation do good. If the case has advanced, nervine tonics, various preparations of iron and strychnine, will prove efficacious. Locally, caustic solution of one drachm of nitrate of silver to an ounce of water may be applied by a brush to the larynx alone, or also to the parts immediately behind the epiglottis. The application may be used every other day, and continuously for two or three weeks. The medicated solution may also be spread over the diseased surface in a minutely divided and misty shower, by an instrument known as an atomizer or a spray-producer. To prevent recurrences the throat should be properly covered with flannel; the beard ought to be allowed to grow. If the tonsils are enlarged and indurated, various astringent gargles and medicated vapours may be employed. Tincture of iodine is the best application to the enlarged tonsils. A camel hair-brush should be used for the purpose. Frequently relief may be obtained by excision of one or of both the tonsils. The patient should avoid the use of the voice. The use for some time of the alkaline mineral waters often has a favorable effect on the laryngeal and pharyngeal mucous membrane in these cases.

ACUTE LARYNGITIS.

Acute laryngeal catarrh is an acute inflammation of the laryngeal mucous membrane. It may be due to extension of a common cold to the larynx, leading to symptoms of redness, swelling, pain, heat, and defective function. The mucous membrane of the larynx is dry at first, but is afterwards bathed in muco-pus. Like other acute inflammations, it either subsides or passes into a chronic form. In rare cases it ends in œdema. Abscesses sometimes form in the submucous tissue. The inflammation occasionally leads to necrosis of the laryngeal cartilages as occurs after typhus or other fevers, in syphilis, and tuberculosis. In these the necrosis generally results in abscess. The abscess projects into the larynx below the vocal cords, and backwards into the œsophagus.

Causes.—Acute inflammation is more severe, but rare. It is most frequent in adults; males suffer more often than females. Exposure to a cold moist atmosphere; cold winds; sudden changes of temperature; previous attacks, if repeated, lead to it. Other causes are—direct irritation of the larynx; inhalation of cold or hot air, steam, or vapour; swallowing hot or corrosive liquids; ulcers or growths in the larynx; direct draught of cold air to the neck; extension of inflammation from the nose or pharynx, or from the bronchi. In adults it is associated with erysipelas, typhus fever, secondary syphilis, and tuberculosis. In renal diseases laryngitis sometimes leads to œdema. Children suffer from croupous inflammation of the larynx.

Post-mortem appearances.—The mucous membrane is of a bright red colour. There is swelling, opacity, and softening, with here and there spots of epithelial erosions. The membrane is dry at first, but soon becomes moist, and secretes glairy mucus which subsequently becomes muco-purulent. In mild cases the redness is diffused, and the vocal cords are injected and swollen, and studded with flakes of mucus and lymph. In severe cases there is thickening and œdema of the glottis, or of the aryteno-epiglottidean folds, or of the false vocal cords obscuring the chink of the glottis.

Symptoms.—The affection is dangerous. It often leads to submucous infiltration, to swelling of the membrane, and death by suffocation. The inflammatory fever is always slight. In the early period there is slight elevation of temperature, flushed face, frequent pulse, furred tongue, great thirst, and loss of appetite. The special symptoms often begin with coryza. The patient complains of dryness, constriction, with burning or tickling in the throat. These symptoms are increased by coughing or speaking. Deglutition is painful, the voice is notably husky or hoarse, or inaudible, and there is a paroxysmal hacking cough with laboured breathing. At first the cough is dry, but after a time clear viscid mucus containing a few epithelial cells is expelled with difficulty. This is known as sputum crudum. When the expectoration becomes more abundant and muco-purulent the sputum is thicker; it contains more pus cells, and is then called sputum coctum. In severe cases, owing to the obstruction in the larynx, dyspnœa is a prominent symptom. The swelling of the membrane and the submucous infiltration leads to lividity of the face. In children it is often attended with œdema of the glottis, and hence is more dangerous than in adults, death taking place from apnœa.

Complications.—Acute laryngitis is apt to be followed by bronchitis, or by pneumonia, or collapse of the lung.

Duration.—The disease generally lasts for three or four days, when the secretion becomes profuse, and the patient recovers.

Diagnosis.—Acute laryngitis is often confounded in children with spasmodic croup (laryngismus stridulus), and croupous laryngitis. It is often impossible to distinguish between these two diseases. The shred of false membrane in the pharynx is the only positive sign that the disease is croupous and not catarrhal. Spasmodic croup rarely commences with coryza; laryngitis often. In acute laryngitis the obstruction in the larynx is appreciable both during inspiration and expiration. The obstruction being limited to the inspiratory act indicates œdema. In œdema the swelling is above the vocal cords and beneath the epiglottis.

Terminations.—Complete recovery, or it may pass on to a chronic form, or may end in death from suffocation in from twelve hours to the fifth day.

Treatment.—The same with that of any other ordinary inflammation of the mucous membrane. The patient should be removed from the influences which may have brought on the attack. He should be confined for a few days in a uniformly warm room, and complete rest must be given to the affected parts. The air within the apartment must be rendered moist by steam, and steam inhalations will subdue the irritability and soreness of the part. The neck should be covered with flannel or a cold water compress. Locally active counter-irritation, as by blisters, should be avoided. Mustard poultices or hot fomentations may be applied to the neck, and if the patient be strong a few leeches at the onset may have a prompt and good effect. Dry cupping or even venesection cautiously tried is preferable in some cases. As direct applications to the larynx, hot steam alone, or steam medicated with turpentine or with antispasmodics, as tincture of belladonna, conium, hops, or benzoin, or even with liquor ammoniæ has a sedative effect upon the part. Where the irritation and the inclination to cough are very great, inhalation or atomised warm vapour containing opium, or the application of a sponge dipped in any of these solutions constantly to the throat may be of service. Small doses of opium internally promote resolution and relieve spasms. Internally mercurials are sometimes given with a view to diminish the intensity of the inflammation and to limit its products. Large doses of calomel internally or mercurial inunction may be tried. In acute cases, nauseating doses of ipecacuanha have been advocated. Opium may be used both externally and internally to relieve pain and distress. Sucking little pieces of ice continuously for some time often gives relief. Where the catarrh has extended to the nose, pharynx, and bronchial tubes, diaphoretics and expectorant medicines should be given. In all cases complete rest to the part is unavoidably necessary. Thus the patient should not, under the existing inflammation, persist in the use of the voice; the strain imposed upon the diseased parts leads to greater congestion and most obstinate forms of chronic laryngitis. After a time the symptoms become aggravated, and there is aphonia and exhaustion. The application of astringents, as the nitrate of silver or various preparations of iron, of tannin, or alum, is always mischievous in acute cases. In the subacute or the chronic form, such local treatment is useful. In severe cases, where, notwithstanding all our efforts, relief is not obtained, and distress increases, as known by the lips becoming livid, tracheotomy must be performed at once. Delays are dangerous. By this procedure the larynx is allowed perfect repose, while suffocation, and the danger of extension of the disease to the lungs, are prevented. In children the danger from acute laryngitis is far less. In them an emetic of ipecacuanha with carbonate of ammonia will remove the accumulated mucus from the larynx, and thus relief is obtained. The further treatment is the same as in adults as regards local applications and inhalations.

Œdematous laryngitis.—This is a rare termination of acute laryngitis. The disease is characterised by rapid increase of all the acute catarrhal symptoms. The patient complains of burning pain in the larynx, with difficulty of swallowing. There is hacking cough with laboured breathing. In a few hours the symptoms are aggravated, and the patient shows evident signs of carbonic-acid poisoning. The diagnosis becomes certain if on an examination by the laryngoscope the aryteno-epiglottidean folds are found œdematous. In such cases an emetic internally, and ice used both internally and externally, or mustard plasters or blisters round the neck, will give relief in a few hours. Should these remedies fail, scarification of the swelled mucous membrane, assisted by the laryngoscopic mirror, ought to be tried. If all efforts fail tracheotomy should be performed.

CHRONIC LARYNGITIS.

Chronic laryngitis may be due to (1) general neglect of acute laryngeal catarrh; (2) repeated attacks of cold in persons of feeble constitution; (3) constant local irritation of the larynx, as by draughts of cold air during undue talking or singing, by extrinsic materials, as coal dust, &c., or by intrinsic growths, such as tubercles (phthisis), cancer, polypi, or syphilitic gummata; (4) the resulting ulcers, as tubercular or syphilitic; (5) indulgence in strong spirituous drinks leads to chronic laryngitis; (6) various nervous disorders; specific, variolous, or non-specific ulcers, lead to the same condition.

Morbid appearances.—As in other chronic inflammations of the mucous membrane, there is extensive tumefaction of the affected part; there is redness and thickening of the cords, especially where they join the arytenoid cartilages. The mucous membrane and the submucous tissue are engorged, the small vessels enlarged and tortuous, the mucous tissue thickened and firm and somewhat swollen. The surface is dry or covered with abundant secretion, and ulcerations are common. The connective tissue is increased.

Symptoms.—The symptoms are much the same as in acute laryngitis, but differing from them in being less violent and more localised, and often attended with œdema of the glottis. The condition often results from ulcers, syphilitic or tubercular, and œdema of the aryteno-epiglottidean folds frequently coexists. The patient complains of a constant tickling of the throat, and of irritation of the pharynx. The voice may be hoarse or cracked or completely absent. Sometimes there is periodic spasmodic cough, causing much distress, and the patients hawk frequently in order to clear away the viscid secretion, which is very much augmented. Dyspnœa is rare, and is present only where there is much thickening of the larynx, and therefore chiefly in the syphilitic form.

The prognosis is very doubtful. The disease takes a very long time to cure. There is generally impaired mobility of the vocal cords, owing to various nervous disorders, or to mechanical obstructions due to disease of the crico-arytenoid articulation. There is considerable tendency for acute laryngitis to supervene upon the chronic form.

Treatment.—Loud talking must be avoided. Rest to the larynx is essential. The patient must wear sufficient warm clothing over the neck and chest. In all cases internal treatment alone is altogether useless. In plethoric cases the state of the alimentary canal must be attended to. If the disease be due to syphilis or to phthisis mercurials or iodide of potassium or cod-liver oil are indicated. Medicated inhalations of belladonna, or of hot steam by means of a spray, or the application of powdered drugs, as alum, to the larynx, by a camel's hair pencil, or by blowing them into the larynx, are the principal methods of improving the condition of the mucous membrane. The chief local applications are strong mineral astringents, sal volatile, also stimulating liquids and sedatives. Chloride of zinc, ʒss to ℥j of water, may be used with benefit. In old cases solution of nitrate of silver, gr. lx to gr. xc, to ℥j of distilled water, or even the solid stick itself, may be tried. In every case we should begin with a weak solution, and gradually pass on to the stronger one necessary for each individual case. Laryngoscopic observation is the most useful and important physical method of investigating chronic diseases of the larynx.

The thickening and congestion which remain after long-standing chronic inflammation may sometimes be removed by the use of electricity, both the constant and the faradaic. The use of electricity is also beneficial in cases where the action of the vocal cords is defective. In old and long-standing cases the disease has a tendency to spread into the pharynx. In such cases the application of iodine or of carbolic acid or iodoform to the pharynx proves of benefit.

PHTHISICAL LARYNGITIS.

Phthisical laryngitis is intermediate between acute and chronic laryngitis, and may occur as an incident of phthisis or of tuberculosis, the tubercles being nowhere else but in the larynx; but it is rare not to have tubercles at the same time in the lungs. Tubercles formed in the lymphatic tissue of the larynx go through the same stages as elsewhere, being at first grey and then opaque, and giving rise to ulcers. The disease creeps on insidiously, and is sometimes far advanced before lung-disease manifests its presence. Like chronic laryngitis, its progress is slow but increasing. It is an incurable malady. When the disease is established the patient suffers from aphonia, from dyspnœa, and from pain in the larynx. Very often morsels of food pass through the rima glottidis.

Morbid appearances.—There are persistent thickenings of the larynx, progressive ulcerations, with extensive destruction of the soft parts, and caries of the arytenoid and other cartilages. In the phthisical form the mucous membrane is of a red colour and soft; the glands are often swollen and prominent, thus giving to the membrane a semblance to a ripe strawberry. In phthisis the epiglottis is very red and granular, and covered with mucus and pus; the posterior parts of the aryteno-epiglottidean folds are similarly affected; the soft parts are thick, often red and opaque; ulcers may sometimes be recognised. The ulcers are shallow, round or oval, saucer-like depressions, of an ash colour, and have swollen edges. Their chief seat is the margins of the vocal cords, in which they have a tendency to extend, and also to destroy them by caries or necrosis. The arytenoid, the cricoid, and the thyroid cartilages are sometimes destroyed by these ulcers. They are also found on the under surface of the epiglottis, and on the back of the larynx, and on the lower aspect of the vocal cords. In some cases the disease gives rise to inflammation of the perichondrium (laryngeal perichondritis) as a very common form of phthisical laryngitis. The inflammation often results in diphtheritic exudation, which takes place between the perichondrium and the cricoid cartilage, the cartilage being nearly displaced by dense fibrous tissue. Suppuration soon results, and the cartilages are necrosed. In some cases the cartilages undergo more or less ossification.

Symptoms.—The patient is generally emaciated; there is a marked hectic flush. The breathing is rapid and the chest very much flattened. The voice is hoarse or even extinguished, speech is whispering and inaudible. There is marked irritability of the organ and frequent cough; sometimes there is a feeling of soreness and burning in the larynx. Where suppuration has taken place, pus with fragments of the tissue is discharged with the expectoration. The disease rapidly spreads.

Treatment.—Counter-irritants applied externally and demulcents, with opium taken internally, are all that can be done for this disorder. The state of the general health should be improved by tonics and good food.

Syphilitic Laryngitis.

The commonest effect of syphilis on the larynx is to set up an obstinate chronic catarrh, to be distinguished from non-specific chronic laryngitis only by the greater degree of thickening of the mucous membrane, by the presence of mucous patches and superficial ulceration, and by the history. Like the skin, the larynx is subject to erythematous inflammation. At a later period of syphilis, mucous tubercles or gummata may exist, and also uniform syphilitic infiltration, causing swelling of the epiglottis, false cords, and the aryteno-epiglottidean folds; the mucous membrane may be of a reddish or white colour, and appears hard. The infiltration often leads to sloughing, ulceration, and even complete closure of the glottis. Ulcers are most frequently seen on the epiglottis. In far advanced cases gummata appear beneath the mucous membrane, and, like the gummata elsewhere, break down and give rise to ulcerations. On examination by the laryngoscope the soft parts are more or less thickened, and ulcers may be recognised at any part of the epiglottis, vocal cord, or of the aryteno-epiglottidean folds. There is a decided tendency for caries or necrosis of the cartilages to take place.

Symptoms, objective.—The breath is fœtid, there is fœtid purulent discharge sometimes mixed with portions of cartilage. The voice is almost always altered in this variety; it becomes hoarse or uncertain or even reduced to a peculiar whisper. Where the tissues above the vocal cords are thickened by syphilitic deposits, or the cords themselves are thickened and immovable, complete aphonia takes place. *Subjective.*—The patient complains of burning, smarting pain, and tenderness in the larynx, which are increased by movement. Deglutition is painful as regards liquids, there is suffocative cough attended with expectoration of pus, blood, and laryngeal tissue-fragments; and there is urgent dyspnœa. Syphilitic laryngitis is often associated with condyloma and warts.

Terminations.—Very often death takes place from obstruction by the necrosed cartilage of the laryngeal orifice, or from perforation of the arteries, and profuse hæmorrhage; occasionally from permanent contraction of the glottis as a sequel of separation of the sequestra.

The syphilitic ulcers are limited and superficial, generally begin on the epiglottis, and spread rapidly and present irregular ragged edges. The margins of a syphilitic ulcer are red and congested, and the ulcers have a tendency to extend at one part and cicatrize at another, and cause contraction and narrowing of the larynx.

Treatment.—This must be both local and general in character. For the earlier affections, mercury is indicated; for the later, the iodide of potassium in large doses, or the two remedies combined, in the form of the red iodide of mercury. The ulcers require local applications, to prevent them from spreading and to promote cicatrisation. The best of these are solutions of nitrate of silver, nitrate of mercury, and chloride of zinc. Iodoform, reduced to an *extremely* fine powder, may be applied by means of an insufflator. Opium may be necessary to relieve pain, and solutions of carbolic acid or thymol may be used with the spray apparatus to correct fœtor. Tonics of all kinds are generally required.

Œdema Glottidis.

It sometimes follows acute laryngeal catarrh. It is a highly dangerous affection, and often causes death by speedy suffocation. The disease causes closure of the rima glottidis, owing to the swelling of the mucous membrane lining it, or from serous effusion into the subjacent areolar tissue above the vocal cords, and in the aryteno-epiglottidean folds on both sides.

Causes.—It may be due to cold, or to swallowing of boiling liquids, or may follow upon some acute or chronic laryngeal disease, or may occur as a complication of erysipelas, or of Bright's disease. The disease occurs very suddenly, and increases most swiftly.

Symptoms.—Sore throat is complained of, and the pain is referred to the pomum Adami. There are sensations of the presence of a foreign body; great dyspnœa; the inspiration is of a hissing character, protracted and laborious; the expiration is free and easy. This is a diagnostic symptom. In laryngitis the obstruction is appreciable both during inspiration and expiration. The voice is hoarse, or is completely lost, showing that the larynx is affected. There is a peculiar harassing cough, with high fever, flushed face, and livid lips. There is marked dysphagia. These symptoms are rapidly followed by restlessness and a feeling of suffocation, and are attended with drowsiness, delirium, and coma. When the affection occurs in patients affected with kidney-disease it is often associated with dropsical effusions in other parts.

In this disease there is swelling on both sides below the epiglottis, which can be felt as a tumour under the fingers.

Terminations.—The disease is often fatal, death taking place very rapidly within a few hours or even minutes. On the other hand, recovery may occur, or the disease may pass on to chronic inflammation.

Treatment.—The patient should remain in a warm room, and the air must be rendered moist by hot steam. The throat must be warmly covered. Small pieces of ice should be constantly swallowed. In mild cases, where the œdema is slight, the topical astringent application of a spray of nitrate of silver solution will suffice. The inhalation of steam is one of the best methods adopted. In severe cases, as the act of swallowing is attended with intense suffering, nutrient enemata are employed. If there be much spasm, chloroform-inhalation, or the vapour of boiling water either alone or medicated with antispasmodics, or the spray of the solution of belladonna, may be tried. A sponge dipped in boiling water should be constantly applied to the throat. If these remedies do not act favorably, if the distress be increasing, and if the blood is not properly oxygenated, tracheotomy must at once be performed. By this operation the larynx is allowed perfect repose, while the paroxysms of spasmodic suffocation and the danger of the disease extending to the lungs are prevented. The œdema, which is nothing more than effusion, may sometimes be subdued by pressure with the finger, or by incisions into the sac by a curved bistoury, but the danger of hæmorrhage and the increased feeling of suffocation caused by the pressure of the finger, in addition to the already existing obstruction, render the operations hazardous.

ADVENTITIOUS GROWTHS.

TRUE CROUP.

Croup is defined to be a laryngeal obstruction due to an adventitious growth, and occurring with febrile symptoms in children. It may be membranous or not membranous; may be due to diphtheria or not so. The non-membranous form has been already sufficiently described under acute laryngitis.

True croup.—Whether it is a contagious disorder or not is not quite decided. It is characterised in its membranous form by the formation of white patches on the mucous surface of the larynx, trachea, and bronchi. It is attended with extreme and progressive debility, and is often complicated with temporary paralysis, is met with in a sporadic form, and is also epidemic. It affects children between three and six years of age, and is generally fatal among them. No season or place is exempt from its outbreak. Those who admit contagion think that it is carried by the breath and may lie dormant in fomites, and can also be given by inoculation. In true croup the membranous exudation spreads over the mucous membrane of the larynx and trachea, and occasionally extends to the bronchial tubes, and hence bronchitis and pneumonia result. It often ends fatally.

In a large number of cases croup supervenes upon pharyngeal diphtheria, and the exudation spreads by continuity. Thus, the croup may be secondary to diphtheria, or may be primary, and may either remain limited or spread to the pharynx.

The vessels of the mucous membrane exude a material which may be stiff and form a layer of false membrane, or may be loose and can be wiped off easily. When stiff it obstructs breathing and causes fatal obstruction of the larynx and of the air-tubes. The shreds of the false membrane partially detached may also lead to fatal spasm. The false membrane is formed in the windpipe, is merely confined to the surface, and when removed there is no loss of substance, and is hence distinct from the diphtheritic inflammation.

Causes.—Predisposing.—Cold, damp, and changeable climate; low and moist localities predispose to it, in weakly constitutions. After the long heavy rains, and during the winter, it is more frequent. The disease may be infectious, as many members in the same family are attacked at the same time. Habitual exposure of the neck and throat to cold and insufficient clothing are the exciting causes.

Pathology.—It is a local inflammation leading to a pseudo-membranous secretion. It also gives rise to swelling and obstruction of the aryteno-epiglottidean folds. The secretion leads to irritation and to the spasm of the glottis, or to the paralysis of the vocal cords, which fall together. It also leads to the obstruction or to the impediment of the access of air to the lungs, and to consequent imperfect aëration of the blood.

Post-mortem appearances.—The mucous membrane of the larynx, trachea, and the bronchial tubes is swollen, congested, and livid, or red; occasionally there are abrasions and even ulcers; very often the surface is covered with a layer of false membrane or with viscid muco-purulent matter. The false membrane is seldom found in the bronchi. Under the microscope the membrane consists of coagulated albumen and fibrin. Ecchymoses are sometimes present, but the mucous membrane is often pale, owing to the contraction of the elastic fibres, which, after death, causes the blood to be driven from the capillaries. The lungs are generally hyperæmic and œdematous, and often present pneumonic spots.

Symptoms.—The disease sets in gradually with symptoms of fever and nasal catarrh, and is accompanied with hoarseness of voice.

The child is usually fretful, and constantly puts his fingers to rub the larynx as if to remove some irritation from that part; there is slight but no real difficulty in swallowing. The fauces are red and swollen. Physical examination of the larynx reveals nothing abnormal. The cough is brassy and ringing, the inspiration is loud and crowing.

As the case advances, or after the lapse of a day or two, the symptoms become well developed, the fever increases in severity, and owing to the obstruction to the free passage of air, and to the proper aëration of blood, the skin gets dusky, the feet cold, and the pulse feeble. The child suddenly awakes from sleep as if suffocated, has great dyspnœa, and a peculiar dry husky cough. He is extremely alarmed and fidgety, tries to sit up or to leave his bed, the face is pale or livid and somewhat turgid, the eyes are suffused and bloodshot. The respiration is peculiar; the inspiration is prolonged, and is attended with a difficult and peculiar crowing noise. These symptoms only subside for a time, and then recur in paroxysms throughout the whole night. Towards the morning there is slight remission, and the little patient slumbers for some hours. This improvement is only temporary, the disease progressing insidiously. In the morning, after the child is awake, the febrile phenomena increase, the dyspnœa becomes greater, the voice more hoarse, and the cough more intense. The child now seizes the throat, or thrusts his fingers into his mouth as if to remove some obstruction. He now becomes extremely restless, and tosses about in bed. The face becomes more flushed and even livid, and with each paroxysm the head is thrown back to take in more air. All these symptoms generally continue in some degree during the day, but are worse at night. Throughout the attack the cough is generally dry, the voice is extremely hoarse and even ends in a whisper, and there is no vomiting. In *favorable cases,* relief is very often obtained by the cough becoming moister, and the expectoration of muco-purulent matter, or by the false membrane, which was exuded on the surface of the larynx and trachea, and obstructed them, becoming detached and removed. The crowing inspiration also ceases.

In *unfavorable cases* the intervals between the paroxysms grow shorter, the feeling of suffocation is more marked, the cough becomes more difficult, and suffocative; the voice is almost lost, and the respiration is croupy throughout; with these symptoms, cold clammy sweats and coma and drowsiness set in. The patient starts in terror, and becomes convulsed. The pulse is extremely feeble, the breathing becomes more hurried and oppressed, the head is thrown back, the alæ nasi are dilated, and the face is extremely livid and is indicative of great agony. The child dies from suffocation, or from exhaustion and coma combined.

Physical signs.—On *inspection* very little is to be noticed in the early stage, or before the brassy ringing cough has set in. In advanced cases there is a considerable amount of obstruction to the entrance of air into the lungs, and the physical signs are those of extension of inflammation from the trachea to the bronchi and lungs. The *percussion* note is resonant. On *auscultation.*—That the inspiratory murmur is indistinct is usually all that can be observed, unless the physical signs of bronchitis or pneumonia be also present.

Duration.—The disease lasts from two days to a week. The majority of cases are at their height about the third day.

Complications.—One of these is cynanche maligna (gangrenous ulceration of the throat), occurring during scarlatina. In it the exudation covers the mouth, fauces, pharynx, as well as the air-passages. The exudation is in the form of pellicles, and often appears as patches of sloughs or as aphthous ulcerations about the mouth and palate in feeble persons. When croup supervenes upon measles or smallpox the fever becomes of a typhoid character, and convulsions are frequent. It is often associated with pneumonia or bronchitis. These complications are extremely dangerous.

Diagnosis.—*From diphtheria.*—Diphtheria, though probably of the same pathological nature, exhibits certain clinical differences, and is distinctly epidemic and contagious. Diphtheria is not sudden in its attack; is not limited to the trachea, but, beginning at the pharynx, may spread and even involve the whole of the respiratory tract, and the false membrane may also be found in other regions. It is a specific constitutional disease attended with high fever and throat complications. It is accompanied by albuminuria and with swelling of the submaxillary glands, and is often followed by paralysis. It is very asthenic. *From tubercular laryngitis.*—Tubercular laryngitis occurs in adults, and is rare in children. In it there is a fixed burning pain in the larynx, there is no exudation of false membrane, and the attack ends in suppuration or ulceration. In both there may be ringing cough, but there is less fever in tubercular laryngitis, and it is also associated with catarrh of the nasal passages. *From spasm of the larynx.*—In the spasm there is no fever, no croupous cough, there are complete intermissions between the fits of suffocation, and general convulsions are often present.

Prognosis.—Is favorable where the respiration is quiet during the intervals, where the cough is attended with muco-purulent expectoration, or with discharge of fragments of exudation membrane, where there is no prostration nor complications. It is unfavorable in cases of obstruction to the entrance of air into the lungs, of closure of the glottis leading to pulmonary congestion; and where the disease extends to the bronchi and lungs. In some cases relapses occur even after the active symptoms have subsided, and more especially in weakly and irritable children. In fatal cases the fever is intense from the first, the attacks of dyspnœa very severe; the cough dry, the pulse is very frequent, small, and irregular, the face is livid, eyes sunken, features contracted, and there are symptoms of great prostration.

Terminations.—Speedy recovery or death. Relapses are common. Sequelæ: Œdema of the glottis. Bronchitis or pneumonia.

Treatment.—In the early stage or when the attack is apprehended, the patient should be confined to bed in a moist warm room, should be placed in a warm bath, and ipecacuanha should be given to promote the expectoration. If inflammation has set in, it should be at once checked, or its force diminished. Bloodletting, or leeches, or antimony, or mercury should be scrupulously avoided. The patient's strength requires support. He must be well clothed in flannel, should have repeated hot and moist fomentations, and even a flannel wrapper round the neck. With this treatment cough, hoarse voice, dyspnœa, and restlessness diminish. Should the treatment not have the desired effect, an emetic of ipecacuanha, repeated every two or three hours, does good. During the remission small doses of Potas. Iodid. will act with benefit. Demulcents, soup, and mild stimulants may be frequently given. If the temperature of the body remains high, reduce it by immersing the patient in a lukewarm bath, which acts both as a cooling and a sedative. During prostration the strength should be supported by stimulants and ammonia. Ammonia also acts in preventing formation of coagula in the heart. To soften and detach the exudation, a spray of warm water, or of hot lime water, may be directed into the throat. Tracheotomy can rarely be recommended, as there is a tendency after it for croup to extend to the bronchi, thus leading to bronchitis or pneumonia. Again, the operation is useless, as death takes place in many cases from fibrinous clots in the right side of the heart. The history of a case in my own practice illustrates what usually occurs when tracheotomy is performed. The patient, a Parsee child, aged sixteen months, was on the point of death from asphyxia. The operation at once relieved it. The child lived five days, but then sank from exhaustion.

MALIGNANT AND NON-MALIGNANT TUMOURS.

These morbid growths are sometimes found in the larynx. The malignant tumours are epithelial, encephaloid, and scirrhous cancers. The epithelial when it exists is always secondary and spreads from the œsophagus. The non-malignant growths are the polypi (mucous), cystic growths, papillomata, and lymphomata. Other morbid growths are associated with scrofulous, syphilitic, or phthisical cachexia. Other growths consist of a deposit of false membrane upon the laryngeal mucous membrane, as found in croup and diphtheria. In thrush and in oidium albicans we also find similar deposit or adventitious products on the larynx. The papillomata have their seat chiefly in the vocal cords. Cysts due to distension of mucous follicles, and containing serous or colloid fluid, are also found. The vocal cords are the most common seat of laryngeal growths, and next to them in this respect comes the epiglottis.

Symptoms.—In case of a tumour, there is a feeling of a foreign body, or a sense of obstruction or uneasiness in the larynx. The obstruction varies with the size and seat of growth. There is difficulty of swallowing, and, if the vocal cords are implicated, there is alteration in the voice. In a majority of cases there is cough with suffocative dyspnœa. When the growth is above the glottis the respiration is quite free, and sometimes the cough is attended with expectoration of fragments of the growths. Where the growth is over the glottis or surrounds it the respiration becomes seriously interfered with. When fragments are expelled, the microscope will assist the diagnosis. The growth can also frequently be seen by the aid of the laryngoscope, and removal is possible in some cases.

ULCERS OF THE LARYNX.

Catarrhal Ulcers.—In hyperæmia of the mucous membrane of the larynx, a condition known as catarrh is generally observed. There is a flow of mucus, and changes take place in the epithelial and glandular cells. The cells proliferate and encroach upon the tissue of the mucous membrane, and their detachment gives rise to abrasions known as catarrhal ulcers. These are rare in acute laryngeal catarrh, but in chronic laryngitis and chiefly in the follicular variety, the mucous membrane of the larynx and that of the fauces and larynx are often the seat of catarrhal ulcers.

Causes.—Preachers and singers are most prone to catarrhal ulcers. Those who smoke heavily and drink in excess often suffer from chronic laryngeal catarrh, and subsequent ulcers. Consumptive patients suffer repeatedly from these lesions. The cause is often of a mechanical nature. Thus, in loud speaking the vocal cords are forced towards one another, and their edges almost touch. In laryngeal catarrh, the loose tissue of the mucous membrane is swollen, and when constant friction takes place during loud talking, ulceration results.

Seat of Ulcers.—The posterior wall of the larynx; the anterior and posterior ends of the vocal cords; the epiglottis.

Characters.—The catarrhal ulcers when single have a rounded or elongated shape. When they have coalesced, the resulting lesion has a very irregular outline. Ulcers involving the mucous membrane are generally superficial. The follicular ulcers are rounded in form, and have less tendency to increase in width than in depth. They often lead to destruction of the larynx.

In phthisis pulmonalis the laryngeal ulcers chiefly invade that part of the vocal cord which is in connection with the arytenoid cartilage.

Symptoms.—These relate to catarrhal laryngitis, viz. (1) harsh barking cough of long standing; (2) chronic hoarseness often leading to loss of voice; (3) a sense of burning or a feeling of soreness, upon coughing or speaking. Where ulceration exists, other symptoms are superadded. Deglutition is difficult and painful, showing that the epiglottis, the aryepiglottic ligament, and the arytenoid cartilage are involved in the ulceration. Another pathognomonic symptom, or rather an objective sign, is the characteristic expectoration. The sputa are streaked with blood.

Physical signs.—The condition of the fauces and gullet is characteristic. When follicular ulcers of the larynx exist, ulcers on the fauces generally coexist. On examining with the naked eye, there is redness of the mucous membrane of the soft palate, with here and there small round sores on the posterior pharyngeal wall. With the laryngoscope, the vocal cords, the ary-epiglottidean folds, the epiglottis, and the arytenoid cartilages are seen to be studded with ulcers.

Treatment.—The treatment is similar to that adopted for the laryngeal catarrh. In catarrhal ulcers, strong astringent local applications are useful; glycerine of tannin will often suffice. Lunar caustic or the strong solution topically applied will answer in more severe cases. The application should be limited to the ulcers only. A small spray-producer or a sponge-probang is the instrument requisite for applying the nitrate of silver in powder or solution. It is better, however, to apply the solid stick directly to the ulcers only. General treatment should not be neglected. The diet should be of a nutritious but simple character.

Typhous Ulcers.—In typhoid fever a morbid process acting upon the intestines, and chiefly upon the solitary glands and the glands of Peyer, gives rise to a diphtheritic inflammation of the glands, followed by ulcers; a similar result follows when the mucous glands of the larynx are affected; in the latter there is medullary infiltration followed by sloughing. These ulcers are characteristic. They appear on the most dependent parts, where hyperæmia from gravitation is rapidly developed. Thus they are chiefly seated on the posterior wall of the larynx and on the lateral edges of the epiglottis. They are small and often circumscribed; and they frequently invade the entire free edge of the epiglottis. In some cases they are deep and occasionally lead to necrosis of the cartilage.

These ulcers do not affect the vocal cords, and hence the voice is unaffected. The fact of the ulcers appearing in the second or third week of the fever points to their typhoid origin. Such ulcers are very dangerous, as they cause œdema glottidis, and laryngeal perichondritis.

Variolous Ulcers.—There are three distinct affections of the throat, due to the infection of measles, scarlet fever, and smallpox respectively. Thus measles is sometimes followed by catarrhal and croupous laryngitis; scarlatina by diphtheritic inflammation of the fauces; and smallpox by ulceration of the mucous membrane of the larynx. The variolous ulcers commence as pustules, which soon burst, leaving shallow, rounded sores. They give rise to symptoms of catarrh of the larynx. The existence of the eruption upon the skin and of pustules in the mouth and fauces suffices to indicate the cause of the ulceration.

Tubercular Ulcers.—In true tuberculosis the larynx is the frequent seat of tubercular ulcers. According to one view, the ulcers are due to the destruction of the mucous membrane of the larynx by constant contact with the acrid sputa. Tubercles are, however, found in the larynx. Where the tubercles are absent their non-existence is due to the fact that the tubercular deposit is superficial, and, by constant contact with the acrid sputa, is liable to be removed, and therefore seldom becomes caseous, or forms any appreciable growth.

Seat.—The ulcers are seated in the mucous membrane covering the transverse muscles of the larynx, in the posterior wall of the epiglottis, and in the covering of the arytenoid cartilages.

Characters.—At first they appear as small flattened elevations or nodules of a dull grey colour. The base is either red and swollen or pale and flabby. The nodules soon decay, and form small rounded cavities, bounded by hard and everted edges. The ulcers generally coalesce and form a large surface of an irregular form; the mucous membrane surrounding the ulcer is also red and swollen. The ulcers have a tendency to spread laterally and in depth. They often extend to the vocal cords. Sometimes they penetrate and destroy the posterior attachments of the cords, and also involve the whole of the larynx, and even the root of the tongue and soft palate.

Symptoms.—These are generally obscure. In a person suffering for a long time from consumption, if there be marked hoarseness of voice, it may be presumed that tubercular ulceration of the larynx exists. In such cases hoarseness is due to paralysis of the muscles of the glottis, and not to any alteration of texture of the mucous membrane, the ulcers being situated upon the posterior laryngeal wall and upon the epiglottis. Hoarseness is also due to relaxation and thickening of the vocal cords, and to the secretion which lies upon them. It is thus that in consumption hoarseness comes and goes, while the ulceration is extending. When the ulceration extends to the posterior attachments of the vocal cords the hoarseness becomes complete. The voice is totally lost and the speech becomes a whisper.

In acute cases the progress is rapid. The mucous membrane is constantly in an irritable state. There are most distressing fits of coughing, often associated with paroxysms of choking, and ending in vomiting. There is often slight sensitiveness to pressure by the fingers over the larynx; such pressure may communicate a feeling of crepitation, but this is also felt during health. Certain other symptoms, aided by the history of consumption, are diagnostic. There is hectic fever, shortness of breath, profuse night sweats, and progressive emaciation.

Physical examination.—On examining the fauces with the naked eye we see signs of chronic catarrh. The vessels appear congested, with here and there marks of erosions. The laryngoscope reveals ulcers on the epiglottis and the arytenoid cartilages. On the posterior wall of the larynx, above the transverse muscle, we see a few spots of a dirty whitish colour. The examination of the chest by percussion and auscultation will establish the diagnosis.

Termination.—Such cases generally die. Death may be due to exhaustion or to œdema of the glottis, but it generally takes place with the ordinary symptoms of consumption.

Treatment.—Very little can be done by way of curing tubercular ulcers. The treatment is chiefly directed towards alleviating the symptoms. Thus the hacking cough and attacks of choking which disturb the patient's rest can best be avoided by keeping the patient in a uniformly heated and somewhat moist atmosphere.

Loud talking must be forbidden. Narcotics, as opium, belladonna, or hyoscyamus may be given freely. The treatment most recommended is the same as for chronic laryngeal catarrh. As the pharynx is congested a concentrated solution of nitrate of silver may be applied with a probang. The patient may be advised to gargle with alum every two or three hours. The direct application of solid lunar caustic to the ulcers has often relieved the annoying cough.

Generally when relief is obtained for the symptoms of pulmonary phthisis the tubercular ulcers improve at the same time. It follows, therefore, that constitutional treatment, medicinal, dietetic, and hygienic, should be carefully adopted.

LARYNGISMUS STRIDULUS (SPURIOUS CROUP).

Spasm of the muscles closing the glottis is incident to acute laryngitis, and is due to the inflammatory irritation. A similar symptom occurs in the absence of inflammation, and is due to irritation of the laryngeal nerves or to reflex causes. Spasm of this kind is characterised by a sudden interruption of the respiration, followed by a croup-like crowing inspiration. It occurs in rickety children, in whom bones and cartilages are soft and muscles flabby and weak. At first the child struggles for breath, next draws a crowing inspiration like that of croup and whooping-cough, the change being dependent, like them, on closure or spasm of the rima glottidis. The obstruction in breathing is paroxysmal, varying in frequency, and may continue for months. From ten to forty attacks may occur in twenty-four hours. Where remissions and exacerbations occur, these are generally due to advance of successive teeth. Spasmodic croup is also sometimes complicated by swelling of the membrane, by submucous infiltration, and by paralysis of the muscles which dilate the glottis. Where it ends fatally spasmodic convulsions usually occur. It is often complicated with other disorders. It is an accompaniment of whooping-cough and is a prominent symptom of epileptic seizure, giving rise to noisy respiration and lividity of the face. It may be one of the many symptoms of hysteria, and may be an element in simple or pseudo-membranous laryngitis. It is often fatal when it occurs in young children. In them during the fit of crying the breathing is suspended for several seconds, the face and lips become blue. After a time the child begins to breathe, and the first respiration is generally sonorous.

Pathology.—The disease is known as spasmodic croup. It is of a purely nervous origin, having no inflammatory cause; is not attended with any structural change. The affection is perhaps due to irritation from pressure of enlarged glands in the neck or chest upon the recurrent nerve, or some part of the eighth nerve, the irritation being conveyed by the vagus or the recurrent laryngeal nerve to the muscles of the larynx. The aryteno-epiglottidean folds fall together, the posterior crico-arytenoid muscles fail to act, and hence the stridor. The irritation may also arise from the brain, as in hydrocephalus, from any organic cerebral mischief, or from morbid growth, as enlarged thyroid, or may be due to reflex causes, as thread-worms, teething, fright, anger, emotions.

Causes.—It is a common complaint in children and those exposed to unfavorable hygienic conditions. Damp situations predispose to it. Indiscretions of diet aggravate it. The disease is rare before dentition or after the age of two years. Inflamed scalp, various intestinal and head affections, bronchitis, pulmonary diseases, and pericarditis are other exciting causes. The scrofulous and rickety are more subject to this affection than others. In adults, although rare, it occurs in connection with hysteria and epilepsy. It is an occasional symptom in aortic aneurism or tumours, as the result of some pressure on the left recurrent laryngeal nerve. There is great tendency for the spasm to recur. Straining of the body, as by violent exercise, crying in children, incessant coughing in children, any abdominal distension, or sudden awaking from sleep, give rise to the fit in persons subject to the attack.

Symptoms.—In children spurious croup sets in very suddenly, and especially at night and during sleep, with more or less embarrassed breathing, with croupy cough, and sonorous inspirations. The glottis may be completely closed, so that respiration suddenly ceases for half a minute or longer. There is no fever; the obstruction is violent and paroxysmal. The child struggles for breath, and owing to laryngeal obstruction the face appears quite livid and is often distorted. There are general convulsions, or partial contractions of the flexors of the thumbs, fingers, and toes. These are followed by relaxations of the involuntary muscles. The attack subsides suddenly or slowly, and when it ends the child generally cries. When the paroxysm is relieved the voice is generally not affected; it is neither hoarse nor husky, and there is no cough. The surface of the body is cool, and there is no fever.

Terminations.—Recovery is almost certain, but rare cases have ended in death from suspended respiration, or, in cases of recurrence, from exhaustion, or by stagnation of blood, with effusion on the brain.

Diagnosis from true croup.—Spasmodic croup has sudden accession and sudden departure, there is free breathing between the paroxysms, and absence of fever, hoarseness of voice, and paroxysmal cough.

Treatment.—During the fit which occurs during crying relief may be obtained by shaking the child, by dashing cold water in the face, by tickling the throat so as to excite vomiting, and by a warm bath with cold douche on the head. If due to indigestion an emetic is followed by a speedy relief, if it can be taken. In every case occasions for violent crying should be prevented as far as possible. Mustard plasters to the neck and hot footbaths often give speedy relief. A hot sponge to the neck as a fomentation often serves as an efficient remedy. Artificial respiration is sometimes useful in cutting short an attack and preventing the recurrence. If spasm be due to reflex irritation the cause must be removed. In prolonged cases chloroform-inhalation may be tried. In hysterical spasm the inhalation of chloroform at once restores the patient. The administration of bromine salts, assafœtida, musk, &c., either by the mouth or by the rectum, may be tried. Where spasm is due to ulcers in the larynx, the best local application is nitrate of silver; and if due to œdema, scarifications of the glottis. Lancing of the gums may be necessary in some cases. Tumours or swellings may be removed by surgical operations. Where all remedies fail, and danger is imminent, as a last resource tracheotomy may be performed. During the intervals, the diet, the state of general health, and the condition of the alimentary canal must be attended to. If the disease depends upon imperfect digestion and poor state of blood give tonics, and for the rickety state give cod-liver oil. Change of situation, warm clothing, and sea-bathing are useful. Exercise in the open air should be enjoined.

In some cases spasm occurs after the local application of caustic to the larynx. In them the spasm can be avoided by advising the patient to stop breathing during the application, and then to begin to breathe through the nose. A sip of a little cold water also relieves the spasm in these cases.

PARALYTIC AFFECTIONS OF THE LARYNX.

Paralytic affections of the larynx or the vocal apparatus involve the trunk of the pneumogastric, the recurrent laryngeal, or the superior laryngeal nerves. Syphilis and tubercles are the potent causes of these affections.

The vocal apparatus is supplied by the recurrent nerve and the superior laryngeal. The former supplies the adductors as well as the abductors, except the crico-thyroid muscles or the tensors of the glottis, which are supplied by the superior laryngeal nerve. The compressible. In addition, there is headache with transient delirium.

Physical signs.—Fine crepitation is audible with the inspiration in the posterior and most dependent part, and also in front.

In far advanced cases the dyspnœa is extreme; the patient sits upright, with the elbows resting on the bed. The breathing is slow and very laborious. The features are expressive of great anxiety; the cheeks, alæ nasi, and lips are very livid; the hands are blue. The cough is paroxysmal, but the prostration is so extremely severe that the patient is unable to expectorate. The sputa are yellowish, viscid, and often streaked with blood. The pulse is very feeble, very frequent, at times irregular, and often imperceptible. The tongue is coated with a thick brown fur, and sordes cover the teeth. The surface of the body is bathed with perspiration. In a short time the patient becomes collapsed or dies from suffocation. In this far advanced stage the percussion sound is clear all over, except posteriorly, where the chest is defectively resonant. The crepitation now is coarser, its place being taken by subcrepitant and mucous rhonchi. Very often we hear gurgling in the neighbourhood of the large bronchi.

In favorable cases all these symptoms gradually abate. 1. Breathing becomes less frequent, more easy. 2. Soreness about the chest diminishes. 3. The throat is less irritable. 4. Cough more free and less severe. 5. Expectoration less viscid, muco-purulent, and forms a homogeneous mass. 6. The face is less livid. 7. The pulse less frequent and fuller. 8. The prostration decreasing.

Physical signs.—There is improvement in the physical signs. The subcrepitant and mucous rhonchi gradually disappear, and in their place finer sounds are heard. The percussion note becomes clear over a large area, and even the dorsal region is resonant.

The convalescence is slow and protracted. In a majority of cases the chest symptoms subside and are replaced by the rheumatic pains in the head, face, and even eyebrows.

Very often influenza is complicated with gastro-intestinal disorder and disorder of the liver, these latter symptoms forming a prominent feature in the complaint. There is bilious vomiting, often diarrhœa, and the stools are frequently tinged with blood.

Pathology.—Some poison or a depressing agent enters the circulation, and acts on the nervous system. Defective drainage, overcrowding, bad air, and irregularities in diet, play a greater or less part in the causation of influenza. Some attribute the epidemic entirely to atmospheric influence. This latter hypothesis is refuted by the facts that (1) the disease travels over districts without reference to climate or season; (2) the disease prevails in the same

locality without reference to season or weather; (3) influenza has occurred after great atmospheric changes; but these latter are not always present as precursors of an outbreak, and they often occur without being followed by influenza; (4) epidemics have also occurred in different places at the same time, under totally different atmospheric conditions.

Treatment.—The patient should be confined in bed, and the febrile phenomena should be combated by salines and diaphoretics, with salicylate of soda. As there is a tendency to rapid prostration the diet should be liquid, given in small quantities and repeatedly. Stimulating diet should, however, be interdicted.

As the cough is very troublesome and the secretions copious, and the patient cannot expectorate, expectorants, as squills, carbonate of ammonia, or an emetic of ipecacuanha, are serviceable. The pain in the chest requires mustard plasters from time to time, or anodyne embrocations or mustard and linseed poultices. If there be much nausea or vomiting, soda carbonate, with hydrocyanic acid and spirit of chloroform, will relieve it. Very often small doses of morphia check the vomiting. In influenza the patients often become jaundiced. Treatment of jaundice consists in the exhibition of mild mercurials, as grey powder or small doses of calomel combined with Dover's powder. Diarrhœa may be checked by Acid Tannic, Syrupus Gummi Rubri, or bismuth and Dover's powder. Acetate of lead is useful if the stools are watery.

Prostration is best relieved by carbonate of ammonia with cinchona and nux vomica. For the rheumatic symptoms small doses of colchicum, with carbonate of potash and opiates, are the best remedies; and to these may be added quinine and other tonics. Alcoholic stimulants are indicated when there are evidences of prostration and during convalescence.

HAY-ASTHMA,

Otherwise known as hay-fever. It is a catarrhal affection of the mucous membrane of the mouth, pharynx, eyes, nose, and larynx. The bronchi are also sometimes involved. The affection is associated with dyspnœa. It occurs generally in summer, and during the hay season or the time of ripening of grass. The disease generally subsides at the close of the season.

Causes.—It is excited by the pollen of grass, the granules of which during the ripening of grass float in the air and come into contact with the nostrils, conjunctivæ, and the mouth. The effects vary according to certain meteorological conditions and the amount of pollen present in the air. Inhalation of ipecacuanha powder

has a similar effect in some persons. The cases are most frequent in warm damp weather, and the number decreases when the air is dry and hot. After heavy rain the disease disappears. The poison or the irritant is most abundant in the strata of the atmosphere between 1000 and 1500 feet above the level of the sea, whither they are carried by the wind. When the pollen-sac comes into contact with the mucous membrane it absorbs moisture from it and bursts; many minute granules which are a fertile source of irritation are set free. The pollen-grains of many other plants have the same effect as those of hay.

Symptoms.—A person on entering a hayfield, notices the irritation of the parts with which the pollen-grains come into contact. There is violent itching of the hard palate and fauces, and also of the eyelids, nostrils, and face. This is followed by catarrh, with violent sneezing, tumefaction, and watering from the eyes and nose. There is occasional pain in the head. The alæ nasi become red and often bleed. Other and similar symptoms appear in the throat. There is swelling, irritation, and pain in this part, giving rise to partial closure of the Eustachian tubes and to deafness. There is more or less fever. The air passages also become affected, and there is pain and tightness in the chest, slight cough and asthmatic symptoms, as difficult and noisy breathing, with prolonged expiration. A short dry cough, with more or less expectoration, sets in at the close of the attack. The disease lasts for about two or three weeks.

Prognosis is generally favorable. The asthmatic symptoms disappear completely on removal of the exciting cause. Hay fever has no complications. It never leads to pulmonary emphysema.

Treatment.—Avoid exposure to the exciting cause. Exercise which increases the number of respirations, and therefore of pollen-grains inspired, should be avoided. The patient should remain within doors. Under hygienic management and change to the seaside the complaint invariably disappears. The use of cotton wool and other respirators is beneficial. Nervine tonics, quinine, arsenic and iron to some extent prevent the attack. To allay the existing irritation, washing out the nostrils and throat by weak solutions of quinine may be tried. Cold douches and lotions of acetate of lead or of sulphate of zinc to the eyes give relief. Medicated sprays consisting of carbolic acid (grs. 8 to an ounce), sulphurous acid (equal parts), tannic acid (grs. 4 to an ounce), applied to the irritated parts constitute the most rational and at the same time the most efficacious means of treating hay fever. Aconite liniment applied to the nose relieves itching. Inhalation of iodine is also recommended. Ipecacuanha in twenty grain doses has been given

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Otherwise known as hay-fever. It is a catarrhal affection of the mucous membrane of the mouth, pharynx, eyes, nose, and larynx. The bronchi are also sometimes involved. The affection is associated with dyspnœa. It occurs generally in summer, and during the hay season or the time of ripening of grass. The disease generally subsides at the close of the season.

Causes.—It is excited by the pollen of grass, the granules of which during the ripening of grass float in the air and come into contact with the nostrils, conjunctivæ, and the mouth. The effects vary according to certain meteorological conditions and the amount of pollen present in the air. Inhalation of ipecacuanha powder

has a similar effect in some persons. The cases are most frequent in warm damp weather, and the number decreases when the air is dry and hot. After heavy rain the disease disappears. The poison or the irritant is most abundant in the strata of the atmosphere between 1000 and 1500 feet above the level of the sea, whither they are carried by the wind. When the pollen-sac comes into contact with the mucous membrane it absorbs moisture from it and bursts; many minute granules which are a fertile source of irritation are set free. The pollen-grains of many other plants have the same effect as those of hay.

Symptoms.—A person on entering a hayfield, notices the irritation of the parts with which the pollen-grains come into contact. There is violent itching of the hard palate and fauces, and also of the eyelids, nostrils, and face. This is followed by catarrh, with violent sneezing, tumefaction, and watering from the eyes and nose. There is occasional pain in the head. The alæ nasi become red and often bleed. Other and similar symptoms appear in the throat. There is swelling, irritation, and pain in this part, giving rise to partial closure of the Eustachian tubes and to deafness. There is more or less fever. The air passages also become affected, and there is pain and tightness in the chest, slight cough and asthmatic symptoms, as difficult and noisy breathing, with prolonged expiration. A short dry cough, with more or less expectoration, sets in at the close of the attack. The disease lasts for about two or three weeks.

Prognosis is generally favorable. The asthmatic symptoms disappear completely on removal of the exciting cause. Hay fever has no complications. It never leads to pulmonary emphysema.

Treatment.—Avoid exposure to the exciting cause. Exercise which increases the number of respirations, and therefore of pollen-grains inspired, should be avoided. The patient should remain within doors. Under hygienic management and change to the seaside the complaint invariably disappears. The use of cotton wool and other respirators is beneficial. Nervine tonics, quinine, arsenic and iron to some extent prevent the attack. To allay the existing irritation, washing out the nostrils and throat by weak solutions of quinine may be tried. Cold douches and lotions of acetate of lead or of sulphate of zinc to the eyes give relief. Medicated sprays consisting of carbolic acid (grs. 8 to an ounce), sulphurous acid (equal parts), tannic acid (grs. 4 to an ounce), applied to the irritated parts constitute the most rational and at the same time the most efficacious means of treating hay fever. Aconite liniment applied to the nose relieves itching. Inhalation of iodine is also recommended. Ipecacuanha in twenty grain doses has been given

at the very beginning of the attack of dyspnœa, and with good results. Patients subject to hay-asthma should, if possible, remain in large towns or by the seaside, during the hay season.

WHOOPING-COUGH (PERTUSSIS).

It is essentially a neurosis. The disease is characterised by a violent expiratory effort, hard convulsive cough, occurring during expiration, and followed by a long, shrill, and laborious inspiration, which is called a whoop. During inspiration the diaphragm descends with force and the air is drawn violently through the glottis. The cough or stertor is paroxysmal and is followed by the expectoration of tough phlegm, and often by vomiting. It is a disease of childhood, but it also attacks all ages. It is highly infectious, the infection being chiefly in the breath and the sputa. It is sometimes sporadic, but very often epidemic. It resembles various zymotic diseases, and is, like them, contagious. The air of the sick room and the perspiration of the patient are highly charged with the poison. The disease runs a definite course, attacks in most cases once only during life, depends upon a morbid state of the blood, and is due to the introduction of some specific poison, which has the peculiar power of irritating the laryngeal branches of the pneumogastric nerves supplying the bronchial mucous membrane, and thus giving rise to paroxysmal cough.

Causes.—That it may occur from simple exposure to cold is doubtful. It often coexists with or follows an attack of measles. It occurs in children even during the first few months after birth; is more common and severe in girls than in boys. The majority of cases occur in the spring.

Pathology.—Whooping-cough, so far as morbid appearances go, is simply bronchitis. Its infectious character points to a specific poison in the blood, while its peculiar cough seems to indicate affection of some nervous centres. The poison is absorbed by the bronchial and the pulmonary mucous membrane.

Post-mortem appearances are those of the complications. Occasionally the bronchial glands are enlarged; there may be extensive collapse of the lungs, with general dilatation of the bronchi. The dilatation may be due to violent respiratory efforts which cause the whoop. Other occasional post-mortem appearances are those of simple non-specific bronchitis.

Symptoms.—For convenience of description it is divided into three stages. If the poison causes the symptoms of catarrhal pneumonia the attack is sudden, particularly in children. In many cases the virus lies dormant in the system, and the incubation varies from five or six days to three weeks.

1. During this period there is slight weakness complained of until marked symptoms of invasion set in. The invasion stage or stage of exacerbation sets in and varies according to the part most affected by the poison. If the lungs are affected, it sets in with the catarrhal stage, or stage of more or less fever, and begins with a simple catarrh, or coryza, sneezing, injection of the conjunctivæ, with severe dry irritative cough, or cough attended with slight mucous expectoration. The cough is incessant and the exacerbation occurs chiefly in the evening and lasts till the next morning. The patient feels easier until four in the evening; the paroxysms occur several times in a day. There is also dyspnœa, accompanied by disordered action of the heart, owing to impeded circulation of blood through the lungs.

At the end of this stage the symptoms generally become modified. The fever subsides or disappears, and the irritative cough is now replaced by a peculiar paroxysmal cough when the second stage is established.

2. This is a stage of increase, or a stage of convulsive or of spasmodic cough. In it, just before the spasm sets in, the child seems anxious and restless; if lying down, rises up suddenly; if playing, runs to hold some fixed object for support. The cough is of a peculiarly convulsive character; it is dry, spasmodic, and sonorous, also prolonged and suffocative; it consists of a succession of short, rapid expirations, accompanied by a peculiar, long, deep, inspiratory shrill, known as a whoop. This whoop is caused during inspiration by the forcible descent of the diaphragm, and by the violent entrance of air inwards through the narrowed glottis. The cough is attended with a ropy mucous expectoration. During the paroxysm the head, neck, and face become purple and swollen, the eyes are watery, and appear to start from their sockets, and there is vomiting of food. Vomiting is due to catarrhal inflammation of the larynx and upper anterior part of the œsophagus. The catarrh also leads to imperfect action of the posterior-crico arytenoid muscles which are close to the summit of the œsophagus. After the fit is over the child is fatigued and exhausted. In severe cases, bleeding from the nose, mouth, or even from the lungs, occurs. In some children a state of syncope or of insensibility without convulsions, and accompanied by great paleness of the surface, occurs after many paroxysms of cough. Where convulsions also occur the case is generally fatal. In cases attended with convulsions, the cough is accompanied by violent struggling of the limbs and body, and by deep blueness of the hands and feet, as occurs in cyanosis. In some cases, after the fit is apparently over, the child begins to cough again, and may thus have several fits following one

another in rapid succession. The paroxysm of cough generally lasts from about forty seconds to two minutes or longer; is often excited by trivial circumstances. They recur with vigour more frequently during the third or fourth week, after which they remain stationary for two or three weeks, and then gradually decline. They are apt to be prolonged by cold, by a sudden change of air or the weather, or by neglect of hygiene, or by complications. If the brain is affected there is violent delirium and vomiting, and diarrhœa occurs. The disease is rarely fatal in the absence of any complications. It is said to be the most fatal of all the diseases of children under one year of age, and 68 per cent. of all the deaths from it occur under two years of age, and only 6 per cent. above the age of five years.

3. The third, or stage of decline, commences from the time when the disease is on the decline. The child appears well and plays as usual; if the fit has ended in vomiting the child soon after asks for something to eat. The paroxysms are less frequent, less violent, and the cough again becomes catarrhal and loses its spasmodic character, the health improves, and the sleep becomes sound and tranquil. The disease often recurs and chiefly during the winter.

Complications.—(*a*) *Emphysema* follows or often accompanies it. The vesicular variety is more common, and generally disappears with the primary disease. Emphysema is the result of laceration of the air-cells, and it spreads through the lung to the connective tissues of the neck, face, and chest. (*b*) *Catarrhal pneumonia* is also a common complication. It is often preceded by convulsions. In it the child continues feverish throughout the attack; the breathing continues hurried throughout the paroxysms of cough; the expectoration becomes fœtid and glairy, and the paroxysms are not followed by vomiting of food. The stools are occasionally pure white. As the case progresses the physical signs of pneumonia of the left lung become developed. (*c*) *Pulmonary collapse* is a very unfavorable complication, for even in favorable cases the collapse terminates in general debility. Pulmonary collapse is common where there is rachitis associated with whooping-cough. In rachitis the ribs are soft, and therefore yield readily to the atmospheric pressure and also to the contraction of the diaphragm. In these cases the respiration therefore becomes seriously affected, and thus, during convulsive cough or whoop collapse results. (*d*) *Cerebral convulsions.*—This complication is very common in children, and is especially liable to occur during dentition. During the attack of whoop the child gets chills and rigors, followed by burning heat of the surface of the body, and pain in the head. The eyes are fixed; the face is red; and the bowels are torpid. The child is averse to light or sound, and feels drowsy. There is grinding of the teeth, and startings from sleep. (*e*) *Disordered alimentary canal.*—This complication is indicated by the coated tongue, the foul breath, the loss of appetite, by the tumid abdomen, and by offensive evacuations. Vomiting attends the paroxysms of cough, and if incessant, often leads to extreme emaciation and debility. The child also gets hectic fever; the breathing becomes hurried and oppressed; he picks his nose and lips; and may even suffer from tabes mesenterica.

Sequelæ.—Tuberculosis and scrofula are most common sequelæ. Phthisis after a long course of catarrhal pneumonia is likely to occur. Very often whooping-cough terminates in general debility, and also in cases of rachitis, where the ribs are yielding, and give way to atmospheric pressure, the chest is drawn in, and pigeon breast becomes developed.

Diagnosis.—In the first stage the whooping-cough may be mistaken for a simple bronchitis. If there is history of possible infection, or if the patient be of the proper age for the disease and be stated not to have had whooping-cough; if there is vomiting with the cough, it is safe to predict that the true whoop will soon be heard. In the second stage the characteristic cough prevents mistake. Hysterical women occasionally simulate whooping-cough.

Prognosis.—It is generally favorable. Complications are dangerous. So also if the disease occurs in very young children during dentition, or when the child is strumous, or very ill-nourished, or if feverish and disinclined to take food, or if the cough be violent, the intervals of relief very short and imperfect, and if the breathing be hurried, the sleep disturbed, and appetite very bad, there is great danger. If the child coughs more than twelve times in a day the case may be considered serious; if more than thirty times it is almost certain to be fatal. If the disease occurs during convalescence from fevers, or after measles or scarlatina, there is every probability that lung complications will supervene.

Treatment.—General. Remove the cause and prevent complications. Like smallpox or scarlet fever, it arises from a peculiar contagion in the atmosphere, and has a tendency to run a certain course uncontrolled. We must, therefore, allow it to take its course; only the child should be warmly clothed, and kept on nourishing milk diet, and allowed free use of demulcents. If on examining the chest we find mucous râles, small blisters, followed by poultices to the chest, will give relief in a short time. The poultices should be changed frequently. Febrile symptoms will be relieved by salines. Emetics with mild sedative expectorants may often be given with advantage. Sometimes mild cathartics are required to relieve gastric symptoms. Bleeding and antiphlogistics are quite out of place. On the other hand, tonics are indicated. Where the spasmodic cough is very frequent, very violent, long-continued, and the whoop is extremely shrill and prolonged, it should be relieved by antispasmodics. If not soon relieved the affection may exhaust the patient, or close the glottis for a few seconds, and thus entirely stop the respiration, and may give rise to suffocation. In such cases even the mere existence of symptoms of whoop foretells danger, and therefore requires prompt interference. Drosera is a valuable remedy. Narcotics and antispasmodics, as belladonna, opium, and hydrocyanic acid are extremely useful. Assafœtida and even the bromides are often used with success. Purgatives may be given if constipation be present. Where vomiting is intense it should be checked, as it may cause great debility and emaciation. The specific drugs, or those which have attained a high repute, are bicarbonate of potash, alum, and atropia; these shorten the number and duration of the fits of coughing, and also change the character of the whoop. The solution of sulphate of atropia, which contains $\frac{1}{120}$th of a grain in each minim, should be given in doses of one drop morning and evening. Other remedies are sulphur, conium, and dilute nitric acid. For inhalations, the fumes arising from gas-works or the waste products of the distillation of coal have a beneficial effect in relieving cough. Inhalation of carbolic acid or the vapour of turpentine or creasote, of the vapour of tar, and of several volatile oils, is a treatment which produces excellent results. Complications must be treated as they arise. If convulsions occur give bromide of potassium combined with chloral, which will also be found useful in checking the cough. Delirium may be relieved by ice to the head or blisters to the neck. During convalescence attend to the hygiene; avoid exposure to cold; keep the child on generous diet, and let flannel always be worn next to the skin. Locally use stimulant and sedative embrocations to the chest. If the secretions are excessive check them by the use of balsams. A change of air always does good. Small doses of arsenic given with meals will accelerate convalescence.

Diseases of the Bronchi.

Affections of the bronchial mucous membrane are frequently met with. Those most common are due to hyperæmia, and give rise to various nutritive and functional changes known as catarrh.

BRONCHIAL CATARRH.

It is an inflammatory affection of some portion of the bronchial tract. It may be acute or chronic. In a majority of cases it has a tendency to extend to one or both lungs. The disease develops readily or with difficulty, according to the susceptibility of the individual. Some degree of bronchitis accompanies most forms of lung disease. It attacks persons of all ages, but children are more susceptible to it than adults, and during the period of dentition suffer more often from this than from catarrh of other mucous membranes. Attacks of fever, chills, nasal catarrh, and bronchitis are very common. In old people the predisposition is equally great. In them the catarrh very frequently recurs, and the disease is very prone to assume the form of chronic bronchitis. With regard to constitution, there is an unfailing tendency or predisposition for the disease to occur in the weak and debilitated, in those who are badly fed, ill-clothed, and who live in damp and moist localities. Such persons, when exposed to the influence of any trifling irritants, are very prone to suffer from bronchitis. It also occurs as an independent affection, as a result of exposure to any sudden changes of temperature, of chilling of the skin by wet and moisture in the rains, or of exposure to cold winds, either when the body is fatigued or immediately after hard exercise; thus, sitting in a draught of air while perspiring freely is a frequent cause of bronchitis.

The disease attacks individuals who are less able to resist the action of such noxious influences. Thus, it is an accompaniment of cachexia in children suffering from malnutrition, as in rickets, or from scrofulous or tuberculous diathesis. In such cases bronchitis is common. It follows exanthematous fevers, as measles and smallpox. Old people suffering from emphysema or asthma are very liable to repeated and recurrent attacks of chronic senile bronchitis when exposed to the action of any slight irritants. In persons who are badly fed and in flabby individuals the catarrh is more frequent than in well-nourished persons. The effect of long-continued exposure of the feet to wet and cold is well known. The disease is often secondary, and accompanies gout and kidney diseases. In these cases bronchitis is due to defective elimination. Similarly in alcoholism there is often catarrh of the throat, which subsequently extends to the bronchi. In mitral heart disease, the circulation in the lung being defective, the pulmonary congestion leads to congestion or impeded evacuation of the bronchial veins, and subsequent catarrh. In asthma the inspiratory movements are ineffective, and the attack often ends in hyperæmia and bronchial catarrh. In croup the presence of false membrane is sufficient to cause irritation and subsequent catarrh. The disease is very prone to become recurrent.

In pulmonary phthisis acute bronchitis often affects the apex of one lung. Bronchial hyperæmia may also be due to pressure on the abdominal aorta or any of its branches. In cases of peritoneal effusion, or of abdominal tumours of any kind, the resulting pressure increases the stream in other vessels which are not compressed, and hyperæmia of the bronchial and carotid arteries ensues. Such patients suffer from congestion of the brain or lungs. During the shivering stage of ague there is spasmodic contraction of the peripheral arteries, the blood collects in the internal organs, and chiefly in the bronchial vessels, and bronchitis sometimes results. Irritants which act on the mucous membrane give rise to bronchial catarrh. Thus, fur-dressers, thrashers with the flail, fork-grinders, knife-grinders, wheat-sifters, and persons following occupations which give rise to much dust are liable to it. Catching cold is, however, the most potent cause. The disease is never hereditary, but the physical conditions of the respiratory organs which predispose to it are often handed down from generation to generation.

Bronchitis may be acute or chronic. It may extend to the apex or to the base of one lung, or to the apices or bases of both. It may affect one side, or be bilateral. The larger tubes may be affected or the smaller air-tubes only involved. The primary cases are generally acute. In children, excepting the acute cases of capillary bronchitis, those due to cachexia are generally chronic, and have a tendency to end in phthisis. The majority of secondary cases are chronic, except when the disease follows phthisis. Bronchitis which recurs in emphysema is generally chronic.

Morbid appearances.—These are not very marked *post mortem*. They can well be traced in the larynx and trachea during life. The phenomena are identical to those observed in other mucous membranes. There is at first redness and swelling, with arrest of secretion. Subsequently there is transudation of serous fluid, containing epithelial cells and mucous elements. After a time the mucous elements become converted into pus, or become thick and opaque. After the inflammation has subsided the secretion is excessive for a time, owing to high vascularity of the glands. The cell elements of the submucous tissue are increased. In advanced cases, or where the disease becomes chronic, the mucous membrane looks more dusky. It is thickened and tough. The secretions may be copious, may be mucous, muco-purulent, or purulent, with abundant epithelial cells. In some cases fibrinous particles or casts are found in the tubes. The inflammatory process may be limited to the mucous membrane, or may involve the whole thickness of the bronchial tubes, leading to infiltration and induration of the connective tissue which surrounds them. The muscular walls may be stimulated to undue action, or may undergo degeneration or atrophy. In most cases the mucous membrane becomes excoriated, and superficial erosions or even ulcers form. The ulcers enlarge and increase in depth, and the cartilages often disappear by caries or necrosis, often involving in the destructive process the surrounding lung tissue. In some cases the tubes become gangrenous and are converted into irregular channels. Such irregularity of structure very often occurs from over-accumulation of the contents of the tubes or by inflammatory weakening of their walls. Where the secretion is in excess, the air-cells become disorganised, and also become distended with air, and emphysema results, or the cells become shrivelled up and collapse of the lung occurs. The collapse often passes by insensible gradation into lobular pneumonia. Loss of elasticity of the mucous membrane, and of the fibrous coat, and of the contractile power of the bronchial muscles often results in diffuse dilatation of the bronchi, which sometimes becomes very marked. In such cases the smaller bronchi are seen to gape widely, their calibre being larger than that of the branches from which they originate.

Symptoms.—As regards the symptoms, acute bronchitis presents various degrees of severity, according as the larger or the smaller tubes are affected. In mild cases bronchitis affects the large bronchial tubes. The disease sets in with symptoms of nasal catarrh, or cold in the head, occasional chills, but not pronounced rigors, and sneezing, sorethroat, and febrile phenomena. There is great thirst. The perspiration is profuse, and dryness of the skin alternates with its appearance. The fever as a rule is mild, the temperature rarely exceeding 100° or 102°. In children the fever is strong. After a day or two the inflammation extends to the larynx and trachea, as is evidenced by a sense of tightness or a feeling of constriction or oppression behind the upper part of the sternum, and tickling about the windpipe. There is also tenderness over the sternum or a sense of heat, soreness, and actual pain above the suprasternal notch. All these local symptoms are increased by any movement, coughing, sneezing, &c. The respiration is hurried, but there is no dyspnœa. The cough is paroxysmal; dry at first, often irrepressible, and is attended with pain behind the sternum. The voice is husky, and often suppressed. After a short time, generally within two or three days, secretion takes place, and there is a uniformly clear, thin, pearly-white, frothy mucous sputum. With the expectoration the fever decreases, and the temperature becomes normal. The pulse is quiet, and cough less troublesome. Gradually the expectoration becomes more free, and in a day or two a large quantity of opaque, viscid, or ropy mucus is ejected, and the patient's suffering is much relieved. If the attack be severe or prolonged the sputum becomes more purulent, or it may take the form of distinct nummulated masses. Occasionally it is streaked with blood.

Physical signs.—Inspection: The respiratory muscles are in a state of powerful action, and the thoracic movements are increased in frequency. Bronchial fremitus may be felt on palpation. Percussion is normal, unless there be some coincident lung disease. Auscultation: In ordinary cases, where only the largest bronchi are affected, no râles are heard on auscultation. In the case of moderately large tubes, a few dry sounds called the sonorous rhonchus are heard vibrating through the chest; but as generally the smaller bronchi are also affected to a greater or less extent, we also hear a dry hissing sound, called the sibilant rhonchus. This sound is supposed to indicate that the air-tubes are somewhat narrowed owing to the dryness and swelling of the mucous membrane. After a time, as the secretion is poured out, large and medium crepitations, or, as they are often called, moist sounds, are heard; the air in passing through the bronchial tubes mixes with the secretion, and gives rise in the larger bronchi to large crepitation, and in smaller branches to medium crepitation. It is characteristic of the auscultatory signs of bronchitis that they are not localised, but are heard all over the chest; and that after the first stage, which is usually short, they are peculiarly mixed and constantly changing.

Terminations.—The disease generally terminates in a week or ten days. The tendency of the acute catarrh is to end in complete recovery; it may, however, become chronic, or converted into purulent inflammation.

Capillary bronchitis.—The catarrh may attack very small capillary tubes, and is then known as capillary bronchitis. It is common in very young children and in old people, being comparatively rare in adults; it has the same general features as the affection of the larger tubes, but the symptoms are more severe, and especially as regards dyspnœa. The fever is high, and there is great anxiety. The impeded circulation leads to lividity of the lips and of the finger nails, and anxious and distressed expression of face. The dilatation of the nostrils with each respiration shows the difficulty of the breathing; there is occasionally slight delirium, and in weak children convulsions may occur. In such cases the general prostration is extreme. In strong robust persons the cough is violent, and very often there is great restlessness.

The disease sets in with well-marked rigors, severe frontal headache, pain, and sometimes vomiting; the pain in the chest may be slight or obscure; the respiration is difficult and hurried; the pulse is full, but about 90. The pulse and respiration ratio is considerably altered, it may be not as five to one, but about three to one; the breathing is very much interfered with, although, except in new-born children, true dyspnœa is rare. The patient is obliged to sit up in bed. The cough is violent, and attended with abundant, viscid, tenacious expectoration, often streaked with blood, but difficult to eject from the lung. There is extreme prostration, considerable derangement of digestion. The tongue is furred and bowels confined; the urine is scanty, high coloured, and slightly albuminous. The lining mucous membrane of the capillary bronchial tubes being thickened and congested and coated with viscid mucus, completely occludes the air from the lungs; and thus in fatal cases symptoms of suffocation set in. The patient is unable to sit up in bed, and sinks exhausted on the pillow. The breathing becomes more difficult and the lividity is more marked. He has no power to expectorate, and hence the sputum collects in the air passages and causes death by suffocation and venous congestion. Death may also result from apnœa due to the arrest of circulation in the lungs, in consequence of the coagulation of the blood in the pulmonary artery, and in the right side of the heart. In some cases the cough diminishes, but anasarca of the feet and legs appears, with low muttering delirium; and there is coma ending in death. Favorable cases are those where the disease subsides in from eight to fourteen days after the attack. In children under a month old, capillary bronchitis often causes extreme dyspnœa, and even leads to collapse. The child struggles for breath, and frequently becomes partially comatose, with cold extremities; it has no cough, and the severity of the symptoms is due to the fact that the child has not learnt the voluntary effort which is the commencement of the partially involuntary action of coughing.

Physical examination.—On inspecting the chest, the thoracic movements are very frequent and increased in depth, as the patient chiefly breathes with the front and upper part of the lungs. Percussion is normal, or there may be hyper-resonance. Auscultation: Fine and bubbling râles are heard over the posterior parts of the lung and towards the base; sibilant and sonorous râles in front and upper part. This difference is due to gravitation.

Diagnosis.—Bronchitis requires to be distinguished from pneumonia, from pulmonary œdema, and from phthisis. The physical signs enable the physician to make the distinction promptly. In pneumonia and in œdema of the lung there is always well-marked impairment of resonance or dulness. In phthisis, where the impairment of resonance is not distinct, the râles are local and not universal and symmetrically distributed as they are in bronchitis. In phthisis, the dyspnœa is out of proportion to a few scattered sonorous râles and crepitations, and there is marked retraction of the chest. The characteristic cough distinguishes pertussis from the different forms of bronchitis. In bronchitis the temperature seldom rises beyond 101°.

Prognosis.—In capillary bronchitis death occurs from the sixth to the ninth day, and the disease is most fatal in very young and old people. Affection of the large bronchi is less dangerous, and relief generally occurs. The prognosis depends upon the age and constitution of the patient, upon the existence of previous organic disease in the lungs or heart, and upon previous attacks. In adults it is more favorable. Signs of extensive obstruction, urgent dyspnœa, and presence of low adynamic symptoms are serious.

Duration.—The affection in favorable cases begins to decline between the fourth and the eighth day, or passes into a chronic form.

Treatment.—The disease is most amenable to treatment. The patient should be kept in a warm room, of the temperature of 65° or 70°, if he is a resident within temperate regions. The air of the room should be kept moist by means of steam, and the patient may inhale steam from a "bronchitis-kettle" or other apparatus. Within the tropics such a course is to be adopted during the winter. He must be confined to bed, warmly clad in flannel; exposure of the chest to damp or cold must be avoided; diaphoretics, copious hot drinks, warm footbaths, which tend to produce free perspiration, are needed. A large mustard plaster to the chest, or a linseed poultice to the back, will relieve the urgent symptoms, and should be repeated from time to time. If the disease is established the indications are:—(1) To subdue inflammation; (2) promote the secretions if scanty, and hasten their discharge; (3) relieve cough; (4) support the patient's strength; and (5) treat urgent symptoms as they arise. To subdue inflammation in the early stage, if the patient be strong, vascular sedatives may be given, as aconite, digitalis, veratria, or salines with ipecacuanha. In old people ammonia may be added to the salines, and sedatives omitted. If the secretions are scanty, free expectorants, and if profuse, a combination of them with sedatives or narcotics may be tried. The most powerful expectorants are ammonia, ipecacuanha, squills, senega, &c. Those medicines which check the profuse discharge are various balsams, creasote, and turpentine. To allay spasm of the tubes antispasmodics, as conium, ether, ammonia, with demulcents, or with diaphoretics do good. Sedative inhalations of creasote or carbolic acid are often beneficial to relieve cough and to check spasm; they also diminish or loosen the sputa. *Locally.*—Mustard poultices, hot turpentine stupes, or irritating liniments are useful. These act by causing congestion or inflammation of the external surface, and thus relieve congestion of the deeper parts. After the acute symptoms have subsided, blisters or croton oil liniments are serviceable. During convalescence, care must be taken to guard against exposure to cold, damp, and night air; flannel must be always worn next the skin, and a change of air is desirable. In the bronchitis of infants, the secretion must be removed, by means of expectorants and emetics, from the bronchial tubes, otherwise the child will die from apnœa due to pulmonary collapse, or from broncho-pneumonia. The collapse is due to want of power to expectorate, and broncho-pneumonia is the result of obstruction of the tubes by the secretion gravitating into the air-cells. This is best averted by an emetic of ipecacuanha, or by tickling the fauces with a feather so as to cause vomiting. In old people the danger is from exhaustion. In them the strength should be supported by brandy, ammonia, bark, and quinine. Good food frequently given at short intervals is urgently necessary. In severe dyspnœa an emetic may be given to unload the bronchi. In capillary bronchitis great care is necessary in the use of opium. As a rule it should be avoided, as there is tendency to lividity of lips and fingers. Where the heart is weak, digitalis may be given combined with stimulants, or belladonna may be substituted for the digitalis. Chloral hydrate is sometimes very useful in cases in which there is much spasm. It should, however, be given with caution. The bromide of ammonium is generally to be preferred.

In all cases of acute bronchitis, attempts must be directed to prevent the symptoms from becoming chronic. During convalescence, if the secretions continue abundant and purulent, stimulating expectorants of senega and ammonia and bark may be given with benefit. The patient should have a long course of vegetable tonics and mineral acids. The compound iron mixture is also very serviceable. The state of the skin should be attended to, and every attempt should be made to improve the appetite and digestion. In chronic cases a sea voyage often effects a cure.

CHRONIC BRONCHITIS.

Chronic bronchitis is very common in the labouring classes whose occupations expose them to cold or to noxious dust, as potters, miners, millers, &c. It attacks persons in middle or advanced life; may be idiopathic or may follow an attack of acute bronchitis.

As a complication it is very frequently associated with gout, kidney disease, rheumatism, alcoholism, and heart disease. It appears in advanced life in winter, and disappears, partially or entirely, in summer. It has a tendency to recur on the slightest provocation. Generally attacks of chronic bronchitis recur annually, increasing in severity and duration, and separated by shorter and shorter intervals of comparative health. Each successive interval becomes a period of increasing dyspnœa, till at last it merges into a continuous attack, ending only in winter exacerbations. Every fresh attack resembles acute bronchitis at first, but the fever soon lessens, and the expectoration becomes profuse and muco-purulent. The disease is generally prolonged for years, and in some cases ends in consumption.

Symptoms.—The attack usually commences during the winter, and generally in cold weather. The severity may vary. At times there is little or no uneasiness, except slight cough and some expectoration. In some cases there is harassing cough in the morning, attended with copious frothy muco-purulent sputa or sputum resembling nummular expectoration of phthisis, and breathlessness on exertion.

A common variety of chronic bronchitis is known as winter cough. The disease is characterised by a sense of oppression about the chest and shortness of breath on any exertion. The dyspnœa and a violent irritable cough occurring in paroxysms are similar to asthma. It is very annoying every night when first going to bed, and on rising in the morning. It is attended with profuse expectoration, the sputa being more or less difficult to expel. The sputum is yellowish or greenish, and consists of mucus or muco-purulent matter. It usually runs into one mass, but occasionally it remains in separate lumps. It frequently sinks in water, and is sometimes most offensive from decomposition. In very severe and advanced cases there is considerable wasting and debility, loss of appetite, hectic accessions of fever, and profuse night sweats. Hæmoptysis rarely occurs. After repeated attacks these cases may end fatally and somewhat suddenly.

Cases of chronic bronchitis differ widely in their severity and in their symptoms. In some cases the secretion is almost absent, other symptoms being well developed, and hence the disease is called dry bronchitis or dry catarrh.

Very often in old people chronic bronchitis is associated with profuse watery, transparent or ropy, seldom frothy, expectoration. This is called *bronchorrhœa.*

A form of bronchitis called plastic or *croupous bronchitis* is characterised by a fibrinous exudation, which is coughed up in the form of little branches of trees, and long supposed to be pulmonary blood-vessels. It does not differ in its symptoms or physical signs from chronic bronchitis, except in being very obstinate. It generally affects young subjects.

Complications.—Chronic bronchitis is often complicated with dilatation of the right side, and subsequent hypertrophy of the heart, with hepatic and renal diseases, and consequent dropsy. It also leads to certain secondary changes in the lungs, as emphysema and bronchiectasis. It often ends in fibroid phthisis and asthma.

Treatment.—Chronic bronchitis, when fully developed, is incurable. Discontinuance of the dusty occupation and a change to a pure air for some length of time are necessary. The attacks are generally paroxysmal, and should therefore be treated by stramonium and iodide of potassium, remedies very effective in asthma. Dyspnœa is due to increased secretion and thickening of the mucous membrane of the bronchi, with general irritability. These have a tendency to cause spasm of the tubes. It is most important that the patient who has had one attack of chronic bronchitis should take every means to avoid another. He ought to wear flannel or silk next to his skin, and to avoid constipation and excessive indulgence in food. When the attack is present, the most important point is is to keep him in a room of absolutely equal temperature. It is particularly important to take care that the temperature does not fall during the night. Purgatives and expectorants are the most useful drugs. A combination of squills and ammonia, with decoction of senega, is very useful in many cases of chronic bronchitis. The general health should be attended to, and counter-irritants may be applied to the chest from time to time. If there be bronchorrhœa, inhalation of creasote, carbolic acid, or turpentine vapour may be used.

BRONCHIECTASIS.

Bronchiectasis signifies dilatation of the bronchial tubes, and is one of the results of repeated attacks of chronic bronchitis, and may also be a sequela of various chronic lung diseases, as emphysema or interstitial pneumonia. The dilatation may be uniform and *cylindrical*, or *fusiform*, or consisting of several *bead-like* dilatations, or there may be only one dilatation or several large dilatations *of the terminal portion* of the smallest bronchial tubes. It is often confounded with vomicæ which have acquired a smooth membrane, and are in direct continuity with the bronchial tubes.

The generalised dilatation of the tubes in their *whole length*, or diffused dilatation extends from the large to the small branches.

and even to their terminations in the air-cells. The dilatations are rarely uniform. Their walls may be thick or thin or pulpy. In the large tubes their fibrous and muscular coats are firmer, and the interstices between them therefore form distinct pouches. The dilatations rarely affect one whole lung, they are generally limited to a few tubes, and are often surrounded by a healthy lung, or by an emphysematous or a collapsed lung-tissue. This cylindrical dilatation is generally secondary to chronic bronchitis, or more especially to capillary bronchitis. In it the whole of the bronchi are less resilient; the pressure of the accumulated secretion upon the inner surface of the bronchi leads to increase in the calibre of the tubes. The dilatations of the terminal portions of the smallest bronchi are usually globular: they have a smooth, but thick, opaque, and tense internal surface, and they often communicate with small bronchial tubes. These terminal pouches are seldom single, they are often in groups, or may be scattered throughout the emphysematous lung, and may affect the whole of one lobe or one lung. The lower lobe is most frequently affected, and is also diminished in size. The terminal pouches originate in collapse of the lung or interstitial pneumonia. The accumulated secretion in the terminal bronchial tubes interferes with the dilatation of the alveoli, and thus leads to dilatation or destruction and ulceration of the walls of the tubes, and also of the surrounding tissues, and thus small cavities communicating with these tubes are formed. They also lead to collapse of the lung, in consequence of the pressure of the distended bronchi upon the surrounding lung tissue. In collapse of the lung air enters during inspiration, but the collapsed portion does not expand, and other portions become, therefore, compensatorily distended. In emphysema the accumulation of secretion in the terminal bronchial tubes leads to dilatation. The other variety, or bead-like dilatation, occurs when the lung-tissue is contracted.

Physical signs of bronchiectasis.—These vary with the seat and extent of the dilatations, with the amount of their contents, and with the state of the surrounding lung. If the dilated tube contains air as well as liquid, the physical signs will be the same as in a phthisical cavity, and there is more or less retraction and immobility of one side of the chest, dulness on percussion, with large crepitation and gurgling. If the dilatation be small and deep seated and surrounded by the healthy lung, resonance will be more clear, and tubular sounds are generally detected over the middle and lower parts of the affected lung. The sounds are sometimes absent, but if so may be heard after the patient is made to cough.

Symptoms.—These are similar to those of chronic bronchitis, viz.

frequent and paroxysmal cough, and copious expectoration; occasional hæmoptysis and general wasting. The sputa are brought up at long intervals and in large quantities, and they acquire a peculiarly offensive odour, which becomes more intense when they have been for some time in the vessel. The quantity is sometimes enormous, and the odour and the periodical evacuation will serve to distinguish this expectoration from that of phthisical cavities. From phthisis this disease is further distinguished by its comparatively stationary character and the absence of precursory signs of consolidation.

Treatment.—Attention must be paid to the secretions, which must not be allowed to accumulate. If excessive, an emetic will do good. If the fetor be great, inhalation of disinfectants, as creasote, carbolic acid, or thymol, will afford relief; stimulating expectorants and tonics are indicated. Fresh pure air is especially serviceable.

ASTHMA (SPASM OF THE BRONCHIAL TUBES).

Asthma is characterised by periodical recurrences of contraction or tonic spasm of the middle and finer bronchial tubes, and consequent or secondary severe paroxysmal or spasmodic attacks of dyspnœa. Asthma is very often a symptom only, and the dyspnœa of chronic bronchitis, of emphysema of the lung, or of heart disease, or that due to pressure of a tumour on the trachea, has been falsely designated asthma. The word literally means to gasp for breath.

Pathology.—When a nervous disorder, it is dependent upon spasmodic contractions of the transverse muscular fibres of the smallest bronchial tubes. Any irritation, direct or reflex, may act as a stimulus to contraction. The irritation may be direct, in the medulla oblongata, or lungs themselves, or may be the result of pressure of enlarged glands upon the pulmonary portion of the pneumogastric nerve; or may be indirect or reflex as from the uterus, and be thence transmitted to the medulla oblongata. From the medulla it is reflected to the muscular fibres of the bronchi. There is a vaso-motor nervous influence leading to fluxionary hyperæmia, and to subsequent swelling, or tumefaction, of the bronchial mucous membrane. Asthma may depend on a morbid state of the nerve, of the covering of the nerve, or of the structures adjacent to the nerve. Among morbid changes adjacent to the nerve may be mentioned nasal polypi, swelled cervical or bronchial glands, and hypertrophied tonsils. These, by their position, may cause irritative pressure on the nerves of respiration.

The asthma due to ipecacuanha, or to the pollen of hay, is an example of direct causation.

Varieties.—(1) *Organic*, as due to some local lesion or irritation in the bronchi, and spasmodic or paralytic; the true or essential asthma; (2) laryngeal; (3) hæmic, as due to morbid condition of the blood; (4) it may be diaphragmatic, as associated with the tonic spasm of the diaphragm or of the respiratory muscles. In either case it is spasmodic.

Causes.—As a nervous disorder it is rare, and then attacks the young more than adults. It may commence at any period of life. It is more common in men than in women. The first attack is often traced to whooping-cough, measles, bronchitis, or to nasal catarrh. Asthmatic patients know they will have an attack whenever they catch cold. It is a distinctly hereditary disease in some cases, asthmatic parents often begetting asthmatic children. Its relationship with epilepsy and other nervous disorders is doubtful. In some a change of abode or of weather, or the prevalence of a particular wind gives rise to an attack. Thus, some suffer most in a dry, others in a moist atmosphere; but, as a rule, moist air is more suitable than dry air, and a low site better than an elevated place. Direct irritation of gases or vapours, or of solids, or of odoriferous emanations from animal or vegetable matters, food, improper both in quantity and quality, and taken at irregular hours, high-seasoned diet partaken freely at night also frequently excite attacks of the disease. It is often associated with bronchitis and emphysema, and with cardiac diseases, as hypertrophy without complication, as they give rise to bronchial congestion.

Symptoms are often insidious. Like other nervous paroxysmal disorders it follows a definite course; there is a period of invasion, followed by an interval of rest. In some the intervals are very short, in others they last for months. In India the paroxysms often recur with the full moon and with the high tide. At first the patient refers the seat of discomfort to the lower or higher parts of the throat, according to the seat of swelling or congestion. The disease is sometimes preceded by an abundant discharge of pale watery urine, or by headache and sleeplessness, and various other nervous disturbances; but it may come on without any warning. The patient awakes suddenly from sleep or early in the morning with a sense of suffocation, of constriction about the chest, and violently struggles for a deep breath. In vain he attempts various positions for obtaining fresh air, stands erect, leans his head forwards on his hands, or on some support, thus making various breathing efforts, or the shoulders are raised, and the head is thrown back with the mouth open. The alæ nasi are widely dilated to expand the chest. Respiration is accompanied by a great wheezing or hissing noise, perceptible to the patient himself or heard at a distance, and yet hardly any respiratory sound is heard. Shortly after the inspirations and expirations are performed with the greatest difficulty; the hissing sound suddenly comes and goes; the inspirations are normal, or louder and stronger; the expirations greatly prolonged and difficult. Signs of overloading of the venous system and of non-aëration of the blood soon set in; there is no fever; the pulse is small and feeble; the eyes are staring; the face livid; forehead perspiring with cold sweats; the countenance anxious; and the skin is cold and clammy. The action of the heart is violent, irregular, and even unequal. The duration of the attack, with remissions and exacerbations of the spasm, varies from two or three to thirty hours. In some rare cases it may last for days with brief remissions. Generally the paroxysm ends suddenly. Sudden entrance of air into the bronchi leads to puerile breathing. In cases where the attack subsides slowly yawning or eructations end the paroxysm, or cough sets in for a time followed by expectoration of little pellets of mucus, free from blood or pus. This is supposed to be due to the attack ending in hyperæmia and increased swelling of the mucous membrane of the bronchi. The sufferer, as the paroxysm ceases, falls into a state of long-desired sleep. If the attack has been prolonged, the muscles of respiration feel sore all over for two or three days after the attack. Such patients are usually thin and round-shouldered.

Physical signs are those of constriction of the bronchial tubes, and of interference with the passage of air. *Inspection.*—There is swelling of the mucous membrane of the pharynx, larynx, or the trachea. The chest is enlarged and mis-shapen, the upper part being dilated, the lower compressed, especially in the lateral direction. The lung being inflated, movements of the chest are deficient or absent. The intercostal spaces, the supra-clavicular fossæ, and the epigastrium all sink in during inspiration. *Percussion* sound denotes hyper-resonance. *Auscultation* discloses feebleness or absence of respiratory sounds where the tubes are contracted, or loud puerile sounds where the bronchi are free; rhonchi generally all over, but at the close of the disease moist râles may be heard. The change of place in which the rhonchi are heard from one part of the chest to the other is very characteristic. Usually both lungs are affected, but occasionally only one of them, and then the breathing is puerile or in excess on the sound side.

During the interval the patient enjoys good health; the breathing is quiet and free; he has an anxious expression of countenance; the cheeks are hollow; the voice rather harsh; and he has an habitual slight cough. The attacks are generally periodic in their recurrences.

Prognosis is uncertain. When the disease commences in infancy, it often disappears altogether in middle life. When it comes on at an advanced age it is generally permanent. During recent attacks, though the signs of carbonic acid poisoning occur, the poison has a paralysing effect on the muscles of respiration, and thus the danger is averted. Where the attacks are frequent and severe, emphysema of the lungs and hypertrophy of the right side of the heart are almost certain to occur. These organic changes are generally attended with diminution in the severity of the asthmatic attacks; but there is a development of permanent dyspnœa and of other symptoms of emphysema and of chronic bronchitis. The patient is generally miserable throughout; has often irrepressible cough; profuse expectoration; inability to lie down in bed; rapid tendency to venous congestion, cyanosis, and œdema of the legs, scrotum, &c. If these symptoms continue unabated, somnolence and coma supervene, and are followed by death.

Treatment.—Where asthma is threatened, in some cases it may be averted or arrested by removing the source of irritation, and by drinking plenty of coffee, or by sucking pieces of ice. When the paroxysm has set in we must endeavour to find out the cause and remove it. If the stomach is at fault an emetic should be given, or if the bowels are constipated an enema is indicated. In cases of hysteria or uterine disease, special remedies should be adopted for the cure or relief of these conditions. The spasm of the bronchi can be best relieved or mitigated by sedatives, as opium or morphia, and belladonna internally or hypodermically, or by inhalations. Arseniate of soda, in $\frac{1}{20}$th of a grain doses, either in pill or solution, has a great power in promoting respiratory action, and acts as a general tonic. Some recommend inhalation of ether or chloroform. The iodide of ethyl, ten drops on lint three times a day, has also done good in some cases. Nauseant doses of ipecacuanha or of antimonial wine have been tried with benefit. Citrate of caffeine or the tincture of *Lobelia inflata*, about twenty drops every twenty minutes, is sometimes very efficacious. Dhatura in a paper with tobacco leaves, is said to act like a charm in some cases; sometimes cigarettes of nitrate of potash check the fit. Fresh warm air must always be obtained. The sitting or kneeling posture, with the elbows supported so as to raise the shoulders, may be practised. Besides these means ice to the spine, or sinapisms, or turpentine embrocations to various parts of the chest may be tried. Respiration of compressed air is highly beneficial. The compressed air when respired gives much more oxygen to the blood in a shorter space of time than the same quantity of non-compressed air. In asthma there is obstruction to respiration, and this is compensated by the respiration of compressed air. During the interval dusty, windy, or smoky localities should be avoided. The room should be freely ventilated and fresh air constantly admitted. Attention must also be paid to the condition of the alimentary canal, and especially to that of the stomach, and to the functions generally. The condition of general health should be improved by tonics; the cold or tepid shower-bath may be used every day. If the expectoration be copious astringents with sedatives are indicated. Various specific remedies have been tried for the cure or relief of asthma. Some use large doses of iodide of potassium; others recommend arsenic. Quinine in repeated doses sometimes acts well, especially in cases where the intervals are short and regular. If the intervals are very long and of uncertain duration quinine is not efficacious. Chloral hydrate often acts very satisfactorily both in relieving the spasms and checking their recurrence. It may be given in doses of fifteen grains every three hours until the attack subsides. In the intervals, various nervine tonics, as iron, oxide of zinc, and nitrate of silver may be tried. In all cases the diet should be carefully regulated. Distension of the stomach is especially to be avoided. An early dinner, a very light supper, a small amount of starchy food and vegetables, well-cooked fruit, and stimulants in the form of a little weak brandy-and-water constitute the best regimen for asthmatic patients.

DISEASES OF THE PARENCHYMA OF THE LUNG.

HYPERÆMIA OF THE LUNGS.

Congestion or hyperæmia of the lungs always coexists with inflammation, and is chiefly serious because its presence increases the liability to inflammation. It may be active or passive. Active hyperæmia is of most frequent occurrence in fevers. In it there is an increased flow or determination of blood to the lungs. Passive hyperæmia is often a serious complication of mitral insufficiency. In this form the flow of blood from the capillaries of the lung is retarded, the veins are engorged, and their walls abnormally distended. The nutrition and function of the organ are very much interfered with.

Causes.—Pulmonary hyperæmia may be due to increased action of the heart from any cause, as mental excitement, rage, violent exercise; and it often occurs from these causes in young persons at the age of puberty. Active hyperæmia occurs when a direct irribronchus, the entrance of air into the lobe is impeded, and the affected portion thus remains inflated, and it does not therefore collapse on opening the chest. Sometimes blood can be traced upwards into the trachea. The bronchial membrane is swollen, and here and there covered with red congested spots, due to effusion of blood into its tissues, and the tissue is relaxed. Where the whole of the blood is expectorated and the hæmorrhage profuse, all the air-passages are pale and the tissue quite bloodless. In many cases the opening cannot be found. When the fatal issue occurs long after an attack of hæmoptysis, the clots of blood appear in a state of fatty degeneration, and may be found lodged in the bronchi. We also find a portion of the lung in a state of chronic inflammation.

Symptoms.—Slight hæmoptysis often occurs in bronchial catarrh, and is seldom of any grave import. Even profuse hæmorrhage due to hyperæmia, or extreme engorgement of the bronchial capillaries, as occurs in heart disease, or caused by the irritation of the bronchi by any mechanical irritants, is not serious in itself. Fatal cases are due to the blocking up of the bronchi by the blood-clot and subsequent apnœa. In persons of a cachectic habit or scrofulous diathesis, in those who may have previously suffered from palpitation of the heart, or from some dyspnœa, or from hæmorrhage from any other part, especially the nose, the vessels are weak, and if hæmoptysis occurs it is always very profuse, and often ends fatally. Hæmoptysis may come on with or without warning. Patients sometimes feel a hot sensation, as of some liquid, behind the sternum, or a sense of weight or constriction, or a feeling of fulness about the chest. Hæmorrhage may come on suddenly. In both cases they experience a sweetish or saltish taste in the mouth, and a large quantity of blood is brought up by coughing. It may, however, well up without any effort and in a sudden gush, when it may also escape from the nose. The blood may be in a few streaks along with sputa, consisting of mucus, or in so large a quantity as to cause death. The blood is generally bright and florid, and more or less frothy. Occasionally, when it is the result of a clot expelled from the bronchi, where it had obstructed the entrance of air into the air-vesicles and impeded respiration, the blood is dark and in clots. When suddenly discharged and profuse, it is dark and usually liquid. The effect upon the patient is evinced by faintness, or even decided syncope, and considerable mental depression is generally caused. Physical examination of the chest yields for the most part negative results. There is sometimes moist crepitation. In some patients inflammation of the lungs or pleura follows the hæmorrhage, and chronic pneumonia, passing into consumption, is another occasional result.

Diagnosis between Hæmoptysis and Hæmatemesis.

HÆMOPTYSIS.	HÆMATEMESIS.
Difficult breathing, pain in the chest, and sensation as of a hot liquid behind the sternum.	Sickness; heat at the pit of the stomach.
Spitting of blood.	Vomiting of blood.
Blood specifically light, florid; frothy; containing mucus; slightly alkaline.	Dark clots mixed with remains of food, firm and heavy, acid reaction.
Signs of consolidation of lung.	None.
No sickness, or vomiting follows cough; often saltish taste in the mouth.	Sickness; cough follows vomiting.
Faintness rare.	Faintness common.
Shallow chest.	Full abdomen.
Blood expelled in mouthfuls by coughing. Physical signs: marked coarse, moist crepitation in one lung, or in part of a lung; dulness and other signs of consolidation if blood has entered the air-vesicles.	Blood vomited profusely and with food; no physical signs in the chest.
History of scrofula or cachexia generally.	History of portal congestion and of disordered stomach.
Expectoration for some time after the attack consists of mucus, tinged with blood.	Black and tarry stools follow.

With regard to the distinction between hæmorrhage from the bronchial capillaries and escape of blood from a large vessel in a pulmonary cavity, it is generally stated that the loss of blood is much greater in the latter case. This statement is not, however, supported by facts, for capillary hæmorrhage from a mucous membrane is often very profuse, as, for example, in the case of the nose. Moreover, the estimates of patients, with regard to the quantity of blood discharged, are often much exaggerated. As a matter of fact, also, the branches of the pulmonary artery soon become obliterated, as a general rule, in consumption; and when erosion does take place, very dark and venous blood escapes. Bright-red blood comes from the bronchial mucous membrane, or from a branch of the bronchial artery or of the pulmonary vein; and it is only when large quantities of dark blood are expectorated that we are justified in assuming that erosion of a branch of the pulmonary artery has taken place.

Prognosis depends upon the cause. If due to hyperæmia of the mucous membrane or to bronchial catarrh, the affection is probably altogether beneficial. Where hæmorrhage is associated with disease of the heart, complete recovery is of course not to be expected. Where hæmorrhage is the result of a weak and relaxed condition of the bronchial capillaries, the grave prognosis which all physicians except a few Germans, from Hippocrates downwards, have drawn is fully justified in a large proportion of cases. In them the hæmorrhage is followed by consumption in the lung. Profuse hæmorrhage from any cause often ends in death by syncope.

Treatment.—A thorough knowledge of the cause of the hæmorrhage is all-important. The nature of the primary disease from which the patient may be suffering ought to be fully investigated. When due to excessive hyperæmia, and if the patient be vigorous, bleeding is beneficial. On the other hand, a relaxed condition of the capillary walls requires that the general health should be improved by generous diet, tonics, &c. All those conditions which assist further deterioration of the general health should be avoided. Attention to hygiene and sanitary laws does much towards preserving the patients from future attacks. They should avoid all severe mental or bodily work. If pale and anæmic, any preparation of iron will be of great service. During the attack, the patient should have perfect rest both of body and mind. He should lie in a horizontal or half sitting position, the temperature of the room should be low, and all disturbing influences, as conversation and excitement of the mind rigorously avoided. The diet should be liquid and cold. The hæmorrhage can often be checked by ice applied locally to the chest. Astringents are indicated, but the ice compress is the best astringent. The drugs resorted to are sulphuric and phosphoric acids. Common salt about a teaspoonful may be given every two hours. Other efficacious remedies are acetate of lead and gallic acid. The hypodermic injection of ergotine is often successful. Some recommend balsam of copaiba or rhatany. Even turpentine may be tried. In every case opium should be freely administered. It checks cough and subdues restlessness. It is also a stimulant to the heart and calms the nervous system. Ergot and digitalis cause contraction of the capillaries, and are therefore useful in obstinate and recurrent hæmorrhage from the lungs.

HÆMORRHAGIC INFARCTION OF THE LUNGS.

This may occur in the course of heart disease, and as a result of metastasis from thrombosis of a vein, from external suppuration and ulceration, and from sanious wounds. In this condition, the blood is extravasated from the pulmonary capillaries, and we find traces of hæmorrhage generally confined to a small and sharply defined section of the lung, and often bounded by a single lobule. The infarction may exist at the root of the lung or may be found at the periphery. When at the periphery, the extravasated blood can be traced within the alveoli and even around the alveolar walls, thus occupying the interstitial tissue. The hæmorrhage does not cause laceration of the lung-substance, and the alveoli are not destroyed. The infarctions are conical and cuneiform, of the size and shape of the alveoli, with their apices towards the root of the the lung; they are dense in structure and hence readily distinguishable from the air-containing lung-substance. The infarctions occurring in the interior of the lung are larger in size. On careful examination we may trace a clot of blood obstructing some one of the arterial vessels of the lung. In small vessels it is difficult to discover the clot.

Causes.—The infarction generally occurs in disease of the heart. It may also be due to emboli from thrombosis of a vein, or to thrombosis from a suppurating sore or an impacted collection of pus in very debilitated constitutions, or from an ulcer. The infarctions are known as metastases. In either case any one of the branches of the pulmonary artery may become blocked up; hæmorrhage results, and is often followed by irritative lobular pneumonia and small abscesses beyond the seat of obstruction. The hæmorrhage resulting from embolism may be thus explained. Owing to the constriction of the artery, the blood-stream in the capillaries becomes more sluggish; the corpuscles are therefore collected and crowded together in these vessels, which are thus in turn plugged up, and sooner or later become impermeable. The result is an increase in the internal pressure in the artery, with rupture of the walls of the distended capillaries as a consequence. Afterwards, the hæmorrhage ceases, because fibrine is deposited upon the embolus, and the closure of the vessel becomes complete. Pulmonary gangrene is a rare termination of infarction. When this occurs, the nutritive vessels of the lung are the seat of secondary coagula, owing to the compression of the capillaries and the extravasation, and the gangrene is the result of the withdrawal of nutritive materials.

These hæmorrhagic clots very often remain as mechanical plugs unaffected for months, and even years. In some cases they liquify and are expectorated. Where the clots contain much organic or chemical or fermenting matter they generally set up pneumonia and even pulmonary abscesses. The blood is generally coagulated. In the early stage it appears in patches, varying in size and number. We may find a trace of hæmorrhage as a black pigment in the pulmonary tissue. After a time a small patch of hard, white matter, mottled with black, is seen, owing to the fibrin having undergone fatty degeneration. Where the hæmorrhage is of very long standing the fibrin is absorbed, leaving behind traces of pigment-granules (brown) in the lung. In a few cases the clot leads to the formation of an abscess, which in favorable cases shrivels up; its contents become drier, and are gradually absorbed, leaving a trace of cheesy substance behind. In size they vary from that of a pin's head to that of an almond. Those due to disease of the heart are seen as peculiar hard, inelastic nodules, and without air, varying from blackish red, or yellow, to pure white. When cut into they appear as coarse granular masses, and closely resemble caseous pneumonic consolidations. In the immediate vicinity of the affected infarction we generally find collateral hyperæmia and œdema; when due to thrombosis the clots are small in size and cuneiform, and found on the surface. Sometimes a large artery may be found blocked up by a clot.

Symptoms.—The disease is generally secondary to some chronic disease of the heart. The supervention of the infarction is known by a sudden occurrence of extreme dyspnœa, due to the stoppage of a pulmonary vessel interfering with the normal renewal between the blood and air in the air-cells necessary for healthy respiration. There is also cough attended with bloody expectoration. In a short time other symptoms relating to circumscribed consolidation, with subsequent pneumonic inflammation and to pleuritis, appear.

The sputa resemble those of pneumonia, but are less tough and darker, and the patient expectorates for a longer time than is the case in pneumonia. The existence of consolidation, due to the clot of blood, is known by physical signs. Where the extravasation is large, and occupying the surface of the lung, the percussion over that limited spot will be dull, and the auscultation will reveal absence of breath-sounds, their place being taken by bronchial breathing and crepitation.

Another valuable group of symptoms occurring in secondary infarction relates to thrombosis of the right heart. Thrombosis may be suspected if all of a sudden the pulse becomes irregular and the loud abnormal murmur which was heard before suddenly disappears. Percussion over the cardiac region now reveals a more extensive area of dulness than in health.

Cases of infarction due to the passage into the blood of the products of suppuration or ulceration produce symptoms similar to those above described; but the intense fever, the rigors, and the symptoms of inflammation of the serous membranes, which prominently mark cases of septicæmia, obscure those due to mere infarction. The occluded artery may be very small, or the infarction be deep-seated, and the patient being much exhausted, dyspnœa may not be noticed.

Treatment.—The sudden occurrence of extreme dyspnœa, which is due to hyperæmia and œdema of the adjoining portion of the infarcted lung, is a symptom of grave import. The patient is already very weak, and therefore depletion is out of the question. Stimulants in any form—musk, camphor, wine, &c., are indicated. Symptoms of collapse may be relieved by mustard plasters to the præcordia, and hot bottles to the extremities. Should the patient survive, symptoms of subsequent pneumonia or pleurisy require appropriate treatment, such as the local application of cold to the chest.

PULMONARY APOPLEXY—PULMONARY HÆMORRHAGE WITH LACERATION OF THE PARENCHYMA.

The condition designated pulmonary apoplexy is of rare occurrence, except as a result of injuries to the thorax. In this form of pulmonary hæmorrhage the tissue of the lung is broken down by the extravasated blood, which forms a mass of variable size. Such a destruction of the tissue is seldom, if ever, due to capillary hæmorrhage, but, as a result of erosion or laceration of large vessels, it sometimes occurs in scurvy, in tumours of the lung, and in gangrene of the organ. In rare cases fatty degeneration of the pulmonary artery causes aneurismal dilatations, some of which finally give way; but, as above stated, wounds, concussions, and contusions of the thorax are far more frequent causes of pulmonary apoplexy.

The extravasated blood is contained in a cavity in the lung the walls of which are formed of the lacerated tissue. The blood is partly fluid and partly coagulated. If the extravasation be near the surface of the lung the pleura is liable to be torn, and blood escapes into its cavity. All such cases generally end fatally after violent and copious hæmoptysis. In other cases the fatal issue is due to suffocation from extravasation into the bronchi.

The *treatment* of pulmonary apoplexy consists in the use of ice, externally and internally, and the hypodermic injection of ergotine. Stimulants, of course, and opium are needed if life be prolonged.

PNEUMONIA.

INFLAMMATION OF THE LUNG TISSUE.

It is an inflammation of the substance of the lung, and assumes three forms: (*a*) croupous or lobar; (*b*) catarrhal or lobular; and (*c*) interstitial or chronic pneumonia.

Croupous Pneumonia is an acute and often an independent affection. In it the inflammatory processes are identical with those met with in croupous inflammation of the mucous membrane generally. There is at first hyperæmia, followed by exudation of a large amount of serum and of plastic lymph upon the free surface of the air-vesicles. It is otherwise known as *lobar*, as it affects an extensive tract, sometimes the whole or only a part of a lobe, usually towards the base. It most often affects the right lung. It generally begins at the root of the lung, spreads at first to the lower, and then extends to the upper lobe. In old and cachectic people it usually takes a different course, and the upper lobes are first involved. In a few cases the entire lung becomes inflamed, and the disease may even extend to the other lung, giving rise to a double pneumonia.

Causes—Predisposing.—Lobar pneumonia is uncommon in very young children, especially before two years, but, with this exception, it is often seen in patients of every age. The weak and debilitated from any cause, and those who have suffered from previous inflammation of the lung, are more liable to it than others. It may occur as a simple morbid condition, or may coexist with some acute or chronic disease in which the air-passages are invaded by catarrh. Thus, pneumonia is a common complication of measles, acute rheumatism, of Bright's disease, of all the exanthemata, and of the low states of the system produced by alcohol and by syphilis. The *exciting* cause is most often exposure to cold. Pneumonia may also be produced by the direct introduction of foreign bodies or poisonous substances into the lungs. Direct injury to the lung, whether by wounds or bruises, also causes pneumonia. But all these causes are seldom sufficient to account for the disease in a majority of cases. It may be due to some epidemic influence. Thus, during a severe winter, or during the prevalence of north-east winds, cases are most common.

It has been recently asserted that acute croupous pneumonia is a parasitic disease, and that it is caused by the entrance into the body of a peculiar and characteristic micro-organism. Typical micrococci have been found in the alveolar infiltration, amongst the leucocytes and red blood-corpuscles. They are elliptical in form and are connected together in pairs or in longer chains, and they are often surrounded by a capsule consisting of mucin. It must be remembered that under normal conditions the suspended solid particles in the atmosphere, taken in with the *inspired* air, are cast out with the *expired* air by the action of the ciliated epithelium of the air-tubes. Before these organisms can invade the lung the function of the ciliated epithelium must be in abeyance. The occasionally epidemic character of pneumonia has been adduced in support of the above view. The most common theory, of course, is that pneumonia is a typical local inflammation produced by exposure to cold, and that the accompanying pyrexia is merely a symptom of the local lesion. According to a third view, acute pneumonia is a general disease, and the inflammation in the lung is simply the chief local lesion. There is yet another theory, viz. that pneumonia is sometimes an inflammatory and purely local disease, and at other times an infective general disease, and there is much that can be urged in support of this view. It is highly probable that primary pneumonia may arise from more than one exciting cause, and it is not necessary to suppose that even a chill acts directly on the lungs in all cases; the blood may be primarily affected, as in acute rheumatism. But the want of symmetry in the lung-affection indicates the influence of some local cause.

Pathology.—Lobar pneumonia, also called croupous pneumonia, is an inflammation of the substance of the lung. It may affect the whole or only a part of the lobe, and usually the base of the lung is the part involved. There is also exudation of serum and of plastic lymph into the surrounding uninflamed air-cells, and into the minute bronchi. It is divided into three anatomical stages: 1, engorgement stage; 2, exudation stage, or red and grey hepatization; 3, purulent infiltration stage.

Morbid appearances. Engorgement stage.—The lung still contains air. It is of a deep red colour, denser and heavier than in the natural state, the affected part is firmer, more resisting, and less elastic; it pits on pressure, and is slightly crepitating. On section, red frothy serum escapes, which is more or less brown, and somewhat viscid and tenacious; the lung texture is intact, and pieces of it float in water; the tissue is more easily torn. The elasticity and sponginess of the lung-substance are diminished. The vesicles contain serous fluid and air. This is the stage of congestion and of proliferation of the epithelium and newly-formed cells; the condition of the lung is similar to that of hypostatic congestion.

Exudation stage.—The lung is consolidated. The air has disappeared from the vesicles, and the sacs are filled with coherent or unaffected for months, and even years. In some cases they liquify and are expectorated. Where the clots contain much organic or chemical or fermenting matter they generally set up pneumonia and even pulmonary abscesses. The blood is generally coagulated. In the early stage it appears in patches, varying in size and number. We may find a trace of hæmorrhage as a black pigment in the pulmonary tissue. After a time a small patch of hard, white matter, mottled with black, is seen, owing to the fibrin having undergone fatty degeneration. Where the hæmorrhage is of very long standing the fibrin is absorbed, leaving behind traces of pigment-granules (brown) in the lung. In a few cases the clot leads to the formation of an abscess, which in favorable cases shrivels up; its contents become drier, and are gradually absorbed, leaving a trace of cheesy substance behind. In size they vary from that of a pin's head to that of an almond. Those due to disease of the heart are seen as peculiar hard, inelastic nodules, and without air, varying from blackish red, or yellow, to pure white. When cut into they appear as coarse granular masses, and closely resemble caseous pneumonic consolidations. In the immediate vicinity of the affected infarction we generally find collateral hyperæmia and œdema; when due to thrombosis the clots are small in size and cuneiform, and found on the surface. Sometimes a large artery may be found blocked up by a clot.

Symptoms.—The disease is generally secondary to some chronic disease of the heart. The supervention of the infarction is known by a sudden occurrence of extreme dyspnœa, due to the stoppage of a pulmonary vessel interfering with the normal renewal between the blood and air in the air-cells necessary for healthy respiration. There is also cough attended with bloody expectoration. In a short time other symptoms relating to circumscribed consolidation, with subsequent pneumonic inflammation and to pleuritis, appear.

The sputa resemble those of pneumonia, but are less tough and darker, and the patient expectorates for a longer time than is the case in pneumonia. The existence of consolidation, due to the clot of blood, is known by physical signs. Where the extravasation is large, and occupying the surface of the lung, the percussion over that limited spot will be dull, and the auscultation will reveal absence of breath-sounds, their place being taken by bronchial breathing and crepitation.

Another valuable group of symptoms occurring in secondary infarction relates to thrombosis of the right heart. Thrombosis may be suspected if all of a sudden the pulse becomes irregular and the loud abnormal murmur which was heard before suddenly disappears. Percussion over the cardiac region now reveals a more extensive area of dulness than in health.

Cases of infarction due to the passage into the blood of the products of suppuration or ulceration produce symptoms similar to those above described; but the intense fever, the rigors, and the symptoms of inflammation of the serous membranes, which prominently mark cases of septicæmia, obscure those due to mere infarction. The occluded artery may be very small, or the infarction be deep-seated, and the patient being much exhausted, dyspnœa may not be noticed.

Treatment.—The sudden occurrence of extreme dyspnœa, which is due to hyperæmia and œdema of the adjoining portion of the infarcted lung, is a symptom of grave import. The patient is already very weak, and therefore depletion is out of the question. Stimulants in any form—musk, camphor, wine, &c., are indicated. Symptoms of collapse may be relieved by mustard plasters to the præcordia, and hot bottles to the extremities. Should the patient survive, symptoms of subsequent pneumonia or pleurisy require appropriate treatment, such as the local application of cold to the chest.

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Causes—Predisposing.—Lobar pneumonia is uncommon in very young children, especially before two years, but, with this exception, it is often seen in patients of every age. The weak and debilitated from any cause, and those who have suffered from previous inflammation of the lung, are more liable to it than others. It may occur as a simple morbid condition, or may coexist with some acute or chronic disease in which the air-passages are invaded by catarrh. Thus, pneumonia is a common complication of measles, acute rheumatism, of Bright's disease, of all the exanthemata, and of the low states of the system produced by alcohol and by syphilis. The *exciting* cause is most often exposure to cold. Pneumonia may also be produced by the direct introduction of foreign bodies or poisonous substances into the lungs. Direct injury to the lung, whether by wounds or bruises, also causes pneumonia. But all these causes are seldom sufficient to account for the disease in a majority of cases. It may be due to some epidemic influence. Thus, during a severe winter, or during the prevalence of north-east winds, cases are most common.

It has been recently asserted that acute croupous pneumonia is a parasitic disease, and that it is caused by the entrance into the body of a peculiar and characteristic micro-organism. Typical micrococci have been found in the alveolar infiltration, amongst the may pass into cheesy infiltration of the lung. It sometimes ends in cirrhosis or induration. In this chronic inflammation tubercle is almost invariably a morbid product, in other words, this kind of pneumonia goes on to phthisis. Some degree of accompanying hyperæmia occurs in the portion surrounding the inflamed area. It often leads to œdema, and is, in many cases, the actual cause of death. Pleurisy is present in most cases of pneumonia, extending to the periphery of the lung, and is shown post-mortem by a local covering or a deposit of recent lymph. The right side of the heart, owing to impeded flow, is full of blood. There is stagnation of blood in the jugular veins and in the sinuses of the brain. In the liver and in the kidneys the blood is stagnated or may be liquid. Coagula of fibrin are also seen entangled in the trabeculæ of the heart and also under the valves.

Symptoms.—Acute pneumonia may occur as an independent disease, or as a complication of other disorders, and its commencement is somewhat different in the two cases. *Commencement.*—In the first it begins by a single violent rigor, lasting for a long time, often accompanied by elevation of temperature, increased frequency of pulse, and great thirst; very often by vomiting and violent pain in the affected side; generally there is herpetic eruption on the lips in the first twenty-four hours. In children, it begins with convulsions, instead of a chill. If, however, the pneumonia comes on in the course of acute rheumatism, Bright's disease, or typhus fever, its commencement is marked by the addition of dyspnœa to the former symptoms, rather than by a well-marked rigor. The fever and derangement of general health are of earlier date than the symptoms due to inflammation of the lung. In pneumonia there is great prostration from the first, the tongue is coated, and there may be nausea, which takes place ordinarily in all febrile catarrhal affections, and vomiting occurs within a few hours. In primary cases after a day or two the symptoms due to local mischief become pronounced. There is great cough; the breathing is short, accelerated, but not laboured; the skin is hot and perspiring, or very dry; the tongue is furred; the urine scanty, dark-coloured, and albuminous. There are nervous symptoms, as headache, sleeplessness, and delirium at night. There is also pain in the affected side, cough with characteristic expectoration, and gastric disturbance.

In some cases, after two or three days of illness, the crisis sets in; the temperature falls, the symptoms subside, and convalescence is established. In others convalescence is delayed for a week or for a fortnight. When death occurs it is due to asthenia or to gradual asphyxia, or to both combined, and in rare cases to cardiac thrombosis.

Characteristic symptoms of pneumonia.—Early prostration is the great feature of pneumonia. 1. The initial rigor is characteristic, it is generally very severe, and it lasts for an hour or more; is never repeated as in ague and in septicæmia. 2. The temperature rises from the time of invasion; even with the shivering stage it is elevated, but is seldom above 106°. The temperature remains high; the fever is never continuous, but presents morning remissions and evening exacerbations till convalescence sets in. The remissions in temperature vary from one half to two degrees, or may be very slight. In this affection, immediately before the crisis, the temperature reaches a height it never before attained, when it suddenly or gradually falls. In fatal cases the temperature rises rapidly before death to 106° or 107°, or there may be typhoid symptoms, with debility, dry tongue, or delirium, and the condition is often mistaken for typhus fever. 3. Herpetic eruptions appear about the second or third day upon the lips and the alæ nasi. This eruption is a favorable symptom. The vesicles generally appear between the second and the fifth day. They have no relation to the amount of inflammation, or to any particular part affected. Besides the lips and alæ nasi, herpetic eruptions may also attack the eyelids or the ear. The eruptions vesicate, but never pustulate, and leave no scars, but only form scabs, which dry up. Herpes is invariably absent in cases of pneumonia occurring in the course of gout, rheumatism, pyæmic influence, or embolism. In pneumonia accompanying typhoid fever herpes is also extremely rare. On the appearance of herpes the pneumonic symptoms begin to disappear. In youth it is a certain sign of speedy recovery; in the aged, herpes seldom appears. More cases of herpes appear in the male than in the female. 4. There is flushing of the face. The heat of skin is great, and the skin is sometimes dry and parched and sometimes bathed in perspiration. The face in advanced cases is somewhat livid. 5. The pulse is full and strong, or full and dicrotous, at first; later on it becomes small, soft, and feeble. The feebleness of the pulse may be due to depressed action of the heart, owing to a high temperature, so that less blood is expelled by the heart. It may also be due to deficient blood supply in the left ventricle, and less supply in the aortic system. In pneumonia, the inflammatory exudation presses upon the capillaries of the affected lung. The capillaries of the healthy surrounding lung are in a state of hyperæmia, and they together send very little blood to the left heart. As a consequence the pulmonary circulation is interfered with, and hence in severe cases we have blueness of the lips and cheeks. The pulmonary obstruction often leads to congestion of the liver, which is increased in size, and there is sometimes jaundice due to obstruction in the biliary ducts. The pulse may rise from 100° to 150° or 160°, and is feeble and irregular. The frequency is greater as the disease becomes more severe. In ordinary pneumonia it is from 100° to 120°. 6. Pain is an almost constant symptom in pneumonia. It is very severe at the commencement of the disease, but after a time it becomes less and often ceases altogether. In pneumonia affecting the old or the cachectic, and in cases limited to the upper lobe, it is often absent altogether. The pain is generally referred to the affected region, but it is sometimes felt elsewhere. It is of a stabbing character, and increased on movement, on pressure, and on inspiration and expiration. 7. Of all the symptoms due to pneumonia, *(a)* shortness of breath is the one most constant and most prominently marked. *(b)* The respirations are hurried and shallow, and increased to fifty or sixty in a minute. The ratio between the pulse and respiration, instead of being as normally four to one, sinks to two, or to one and a half, or to one. There is dyspnœa; the elevators of the nose are contracted and the alæ nasi are dilated. The inspiration is laborious, and the expiration is short and abrupt. *(c)* In children the voice becomes hoarse and is often reduced to a whisper. Dyspnœa is due to increased combustion and destructive assimilation, as occurs during fever. It is also due to the diminution of aerating surfaces, owing to the inflamed condition of the alveoli, leading to swelling of the alveolar walls and exudation into the air vesicles. As a result, air is excluded, and the interchange of oxygen and carbonic acid to renovate the blood is much interfered with. Shortness of breath may also be due to collateral hyperæmia and œdema of the lung-tissue surrounding the diseased or inflamed portion. The pain on deep inspiration which occurs during pneumonia can best be avoided by breathing superficially, and the appearance of dyspnœa is thus increased. 8. Cough is rarely absent except in the pneumonia of old and debilitated subjects. It often causes so much pain that the patient instinctively uses all in his power to prevent attacks of coughing. In bronchitis, where the cough is seldom attended with severe pain, the patient never tries to repress it. The result of the attempts at suppression is that the cough becomes paroxysmal. It is short and ringing and hacking; is dry at first, but is soon attended with peculiar expectoration. 9. The expectoration in acute croupous pneumonia is at first mucous, viscid and semi-transparent, and continues in this state while the lung is in the first stage or that of engorgement. When the second stage, or that of exudation, is established, the sputum becomes rusty coloured. This is due to its containing blood from the rupture of some of the capillaries, and this variety of sputum is pathognomonic of acute pneumonia. The pneumonic sputa are very tough and adhesive and their colour in the chest, and dyspnœa can be well checked and often subdued by the prompt and continuous application of cold compresses to the seat of disease. Under their use the duration of the disease is shortened to three, four, or five days; it is seldom prolonged beyond a week, when convalescence sets in. The results of the compresses are the same as when applied to an inflamed limb. The inflamed capillaries, which are dilated, become contracted, and the relaxed tissues recover their tone. For high fever cold baths or several small or a few large doses of quinine may be tried. Digitalis lowers the temperature and diminishes the frequency of the pulse, and may therefore be used with great advantage. Other nauseant drugs, as tartrate of antimony and ipecacuanha may be tried, as they act by lessening the fever. Some extol the use of veratria, others of aconite; but these powerful drugs, though very useful in recent cases and in the robust, often cause symptoms of great prostration, and should therefore be used in a limited number of cases and with great caution.

Stimulants afford great aid in almost all cases of pneumonia. In the old and the debilitated they are absolutely indispensable. In secondary cases, their effects are sometimes marvellous. The tendency of the inflammation as it advances, is to lead to profuse exudation and to protracted fever, both rapidly ending in exhaustion. In these conditions stimulants are the only safeguards. In all pneumonic cases, the action of the heart is weak, there is a marked tendency to collateral œdema, and to paralysis of the bronchi leading to retention of the exudation products. In such cases stimulants alone will produce gratifying results. The best stimulants are camphor, musk, and brandy. The benzoic acid given with a view to facilitate expectoration is highly useful as a stimulant. Should expectoration be profuse, sedatives may be given. If very scanty, alkalies are recommended, or the hydrochlorate of ammonia with balsams. If the patient passes restless nights Dover's powder may be administered. The diet should consist of beef tea, soup, milk, and light puddings. Eggs may also be given after the first few days. Locally blisters should not be used; but fomentations, with or without anodynes, or with turpentine, or sinapisms to the chest are useful to relieve pain. In old chronic cases, where the fever has abated, and dyspnœa only continues, relief may sometimes be obtained by a blister to the chest. Carbonate of ammonia in large doses and alcohol form the best stimulants during the crisis, as after so many days of illness there is not only the weakening proper to the disease, but the deteriorating effects of imperfect aeration, &c., have to be combated. Besides, the food is not taken in sufficient quantities nor properly assimilated to meet the extraordinary tissue waste. During the crisis the lung also tries to free itself of its consolidation or exudation. The main indications for stimulants are: delirium, pneumonia of destitution, and of drunkenness. In pneumonia which appears after severe nervous shock, or after long exposure, when there is very rapid and weak pulse, signs of prostration or collapse, the patient old, and the disease not primary, stimulants are the only remedies in which hope can be placed. In all cases good nourishing diet should be administered at regular intervals.

Many cases of pneumonia do well without alcohol; others can be kept alive by alcohol alone. It is best given in the form of whisky or brandy. Where there is much pain in the side, Dover's powder, in five-grain doses every five or six hours, will relieve it, and enable the patient to breathe more comfortably, and so to make the best use he can of his lungs.

LOBULAR OR CATARRHAL PNEUMONIA.

The word *catarrh* applies strictly to inflammations of the mucous membranes; but as a mucous membrane associated with mucous glands has not been demonstrated in the pulmonary vesicles, the term is not strictly applicable to the disease about to be described. For the sake of clearness, however, as the disease is generally preceded by bronchial catarrh, and because of the analogy between its inflammatory changes and those of bronchitis, it has been retained. It is an inflammation limited to single lobules scattered over the lung substance in patches, which present the ordinary features of red or grey hepatization, and vary in size from a hemp-seed to an egg. It occurs in young children and in old persons. Very often these lobular patches coalesce, and thus a large portion of the lungs may be affected.

Pathology.—There is no fibrinous exudation as in the croupous variety, but merely proliferation of the epithelium cells lining the alveoli and of granular cells. These cells [illegible] undergo degeneration, and are absorbed or discharged. [illegible] they rarely form abscesses, but they often undergo cheesy degeneration ending in destruction of the lung-tissue. [illegible] sometimes the [illegible] [illegible] [illegible] of the lung, or [illegible] may set up chronic interstitial pneumonia.

Causes.—Capillary bronchitis, whooping-cough, diphtheria, and measles are the chief precursors of the disease, which may be acute or chronic. It is generally secondary to bronchial catarrh, or the disease which ends in the blocking up of minute bronchi. Collapse of the air-vesicles beyond the seat of obstruction takes place, and subsequently catarrhal pneumonia is developed in the collapsed lobules. It may also result from the extension of inflammation from the minute bronchi to the air-cells, or from the entrance into the air-cells during inspiration of the inflammatory products of the bronchial tubes, such products irritating the air-vesicles and producing inflammation. During collapse of the lung the air-cells do not contain air, the capillaries of the alveolar walls are liberated from the pressure of air upon them, and they become hyperæmic. The hyperæmia after a time ends in proliferation of cells and transudation of fluids. Closely allied to lobular pneumonia is another variety known as *disseminated pneumonia.* This is due to the obstruction of small branches of the pulmonary artery by emboli or thrombi, as may occur in the course of pyæmia. Catarrhal or lobular pneumonia, when it occurs, has a rapid tendency to run on to suppuration or even to gangrene, and the affected part is frequently the seat of hæmorrhage. In weak and elderly persons, in those suffering from acute or chronic diseases, or exposed to impure air, it is extremely common. In children it often occurs as a complication of measles, whooping-cough, and diphtheria. In these affections bronchitis and pulmonary collapse are common, and often end in catarrhal pneumonia.

Post-mortem appearances.—The inflamed lobules are scattered through both lungs, being most abundant towards the bases and along their lower free border, and also towards the surface. They are firm and wedge-shaped, with the base outwards and somewhat projecting beyond the surface, where each lobule forms the centre of pleural exudations. They are friable and break easily under the fingers. On section they are at first of a bluish-red colour; later on, when transudation and cell growth increase, they are light or greyish. The surface on section is smooth and homogeneous, but never granular as in the croupous variety: pressure forces out opaque fluid, at first bloody and containing abundant cells, subsequently pale grey and containing cells in a state of fatty metamorphosis. They are also mixed with pus and mucous corpuscles. In cases due to collapse, the inflamed lobules are most abundant towards the bases and along their lower free border. They are of a deep scarlet colour; they are voluminous and resistant, and form knots of irregular form and size: on section a tenacious secretion oozes out, often mixed with pus. All these changes are similar to what occurs in cases of red hepatization and purulent infiltration, but in this form there is cell growth instead of fibrinous exudation. The affected portion in many cases readily sinks in water. There is a tendency to the development of bronchitis, and to the effusion into the small bronchial tubes of a viscid sanious fluid. The effusion undergoes coagulation, and thus forms casts in the tubes of coagulated fibrin and of corpuscles. The small bronchi are also found to contain pus.

Symptoms.—The disease is often associated with, and is generally preceded by, capillary bronchitis, or pulmonary collapse. The symptoms are mere modifications of those of its originating disorder. The chief characteristic symptoms are the cough and fever, and they generally set in after some time. The disease is to be suspected if the child fears to cough, and already sick with each cough, appears distressed as from pain in the chest; fever with high temperature is an important sign. The rise of temperature of the body begins with the catarrhal pneumonia. In bronchitis it is seldom above 102°. If pneumonia sets in during bronchitis the temperature rapidly rises to 104° or 105° within a few hours. Remissions and exacerbations are liable to recur even after the temperature has become normal; at the same time the pulse is frequent, feeble, and irregular; there is frequent breathing, great restlessness, and often the child becomes somnolent. In adults this form of pneumonia occurs in connection with pulmonary hæmorrhage and pyæmia.

Physical signs.—They are exceedingly uncertain; there may be none whatever for the first day or two, or a few may be present. In cases secondary to collapse of the lung, there may be a symmetrical narrow strip of dulness on both sides of the spinal column, increasing upwards at first, but very slowly, extending laterally, and only at a very advanced period of the disease. After a time dulness spreads, and there may be increased vocal fremitus, bronchial breathing, and râles, similar to those heard during the exudation stage of pneumonia.

Progress is extremely acute in debilitated subjects; the disease may end fatally in a few days; weak patients soon fall into an apathetic state, and when this result is imminent, the symptoms of carbonic acid poisoning come on. Resolution is never sudden, as in croupous pneumonia. When it occurs it is usually gradual and extends over many weeks; the disease may lead to a permanent lung mischief, *e.g.* fibroid pneumonia, a most common form of phthisis.

Terminations.—Abscess in the lung is a very rare sequel. Caseous infiltration is most common. The disease often ends in cirrhosis of the lung, or in the increase of the interstitial connective tissue, with subsequent shrinking and wasting of the pulmonary stroma.

Prognosis.—Very unfavorable. It generally ends in chronic pneumonia or phthisis.

Treatment.—Emetics sometimes are serviceable to unload the lungs, sinapisms may be also necessary; abundant nourishment is required with stimulants in many cases. Friction with oil over the chest is recommended. Stimulants must be freely given in low states. The application of cold to the chest has been tried with good effect.

FIBROID PNEUMONIA.

Fibroid pneumonia.—Otherwise called chronic or interstitial pneumonia, or fibroid phthisis, or cirrhosis of the lung. It is rarely primary. In this disease the interstitial connective tissue of the lung becomes increased and hardened, so that the lung is solid and hard, and when cut presents a smooth shining appearance, and gives a creaking sound to the knife. It is a sequel of old pleurisy or of chronic bronchitis, and the gradual passage from chronic bronchitis into this disease is indicated by a steady aggravation of the symptoms. It may occur also in connection with bronchiectasis, tubercle, cancer, hæmorrhage, or foreign body in the air-cells.

Causes.—The disease is rarely primary, it is the sequel of chronic affections of the lung. It may be due to continued exposure to irritant gases or solids, as coal dust, millstone, copper ore, flax dust, and other mineral and vegetable powders, in which cases bronchitis is first set up. In cases of collapse of the lung there is often infiltration of the connective tissue ending in cirrhosis. Similarly the disease is often secondary to, or an extended form of catarrhal and croupous pneumonia. Besides the irritant gases or solids, the presence of tubercles in the lung, of a cancer or of a hæmorrhagic infarction, sometimes leads to cirrhosis. In all these cases there is at first caseous infiltration before induration takes place.

Pathology.—In the normal lung there is a sort of rudimentary connective tissue which forms the air-cells, surrounds the lobules, and also extends round the blood-vessels and the minute bronchi. In interstitial pneumonia there is an inflammation of the interstitial tissue of the lung, just as occurs in cirrhosis of the liver; some believe it to be not an inflammation, but a thickening of the alveolar walls and of the interlobular tissue by a fibro-nucleated growth, with gradual obliteration of the alveolar cavities as a result. The development continues until the fibroid tissue finally reaches the whole organ, which is dense, hard, and airless; there is no free exudation in the air-cells, or in the interstices of the tissues, as in croupous and catarrhal pneumonia. In this affection the inflammatory changes affect the nutrition and function of the intercellular and interlobular tissue. The process is merely a hyperplasia of the connective tissue, and the lung becomes indurated. The air-vesicles are diminished in size. The neoplasm or the degenerated tissue undergoes further changes. The induration takes place by the development of nucleated fibroid tissue around the bronchi, or in the interlobular septa, or in the walls of the air-cells, or in all these places at once. The cirrhotic portion, which was at first soft and vascular, gradually contracts and becomes callous and bloodless, and occupies a smaller space than the healthy lung. In persons working in coal mines, and who suffer from this disease, besides this growth, there is an abundant deposit of pigment in the walls of the air-vesicles, and in the connective tissue and in the bronchial glands.

Post-mortem appearances.—The cirrhosed lung when cut is mottled. The lung when noticed post-mortem is generally contracted and shrunken, its tissue hard and dense, the alveolar walls thick, and the interstitial tissue degenerated. The cirrhosed lung does not break under the fingers, and creaks on being cut. On section the cut surface is smooth and dry and red at first, but afterwards presents a grey aspect. In advanced cases it is whitish or streaked with pigment. Dense fibrous bands are seen traversing the thickened portions and surrounding bronchi or the blood-vessels; the vesicles are destroyed, the larger bronchi dilated, and the caseous and fibrous growths are here and there blended with abscesses. The smaller tubes are dilated into bulbs at their ends, and they form cyst-like expansions, or open cavities of larger size. Often the adventitious growth undergoes liquefaction, and thus forms vomicæ, or is connected with several dilated tubes. Calcified concretions are also sometimes found. The air-cells become obliterated, retaining disintegrated epithelial cells, and emphysema is usually developed synchronously in the surrounding healthy lung. The disease is generally limited to one lung. The pleura is usually thickened and adherent.

Varieties of cirrhosis. Red induration.—Is an early condition of the disease. The lung is large sized, red, and fleshy, denser than in health, and infiltrated with fibroid growth. It still contains air. *Brown induration.*—The capillaries are dilated and thick, the lung has a yellowish-brown tint, and contains the pigment colouring matter of blood. It is a general accompaniment of heart disease. *Grey induration.*—Is an advanced stage of cirrhosis. The lung is grey and even translucent, and contains abundance of fibroid matter. *Black induration.*—Occurs in cirrhosis in persons who work in mineral dust, and is generally fatal.

Symptoms.—When due to croupous or catarrhal pneumonia, the primary disease lasts for many weeks when the patient gradually loses flesh and strength, the nutrition is impaired, and there are

Very little can be done to improve the degenerated condition of the lung substance; sometimes the long-continued administration of iodide of potassium is found to promote absorption in such cases. The cavities, however, cannot be closed or obliterated. The pent-up and irritating secretions within the dilated bronchi ought to be first removed, and when this has been effected attempts must be made to check the further secretions. The cough and expectoration demand sedatives. The fœtor of the sputa can be corrected by the inhalation of disinfectants, such as oil of turpentine, thymol, iodine, &c. The profuse expectoration may be checked by ʒss doses of oil of turpentine and ♏xv to ♏xx doses of the tincture of belladonna. Change of air, cod-liver oil, and tonics are essential. More relief, however, can be obtained by inhaling oil of turpentine than by any other means. This remedy checks secretion, corrects fœtor, and promotes the evacuation of the cavities. The inhalations should be used several times daily.

GANGRENE OF THE LUNG.

Gangrene of the lung is a condition in which the lung is necrosed. The lung is an organ which, like the skin, is exposed to the contact of air. Any putrid material remaining in contact with an inflamed or ulcerated tissue in an exposed portion of the body sets up decomposition, and may lead to gangrene. Similarly, any irritant getting into the air-passages, and remaining in contact with the already disintegrated lung tissue, may induce a similar result. Gangrene follows hæmorrhagic infarction, as occurs in cases of heart disease, and metastatic infarction, caused by an embolus produced in some part of the body in which putrefaction is going on. It likewise occurs, though rarely, when the pneumonic process is at its acme, the processes of circulation and nutrition being absolutely arrested in the inflamed portion; it sometimes occurs in phthisis and in cancer of the lung.

It presents itself in two forms—circumscribed and diffuse. The former occurs when an embolus obstructs one or more of the nutrient vessels of the lung, leading to hæmorrhagic infarction, as seen in cases of disease of the heart. The diffuse variety is common in pneumonia occurring in drunkards, and in those who are very much debilitated by dissipation and want of food. It is also met with in cases of pneumonia occurring in lunatics.

Post-mortem appearances.—The circumscribed form is the more common. The diseased portion may vary in size from a small nut to a considerable portion of the lobe; the lower lobes and the superficial peripheral parts are chiefly affected. In isolated parts the lung-tissue is changed into a bluish-green colour, is moist, and fœtid, is abruptly limited, and the line of demarcation is surrounded by œdematous or hepatized lung-tissue. At first the gangrenous spot is tolerably firm, but soon decomposes into a thickish, dark liquid, mixed with rotten *débris* of the tissue. The liquid slough may discharge through a bronchus, setting up bronchitis; it rarely empties into the pleural cavity or into the surrounding cellular tissue. In some cases the gangrenous portion of the lung is expelled, and a fibrous capsule forms, with a cavity containing healthy pus, and which may ultimately close up and cicatrise. In a few cases gangrene of the pleura is associated with the disease in the lung. In the diffuse form the entire lobe of the lung is frequently gangrenous, its parenchyma is decomposed, and is converted into a pulpy, black, moist substance; it does not present any line of demarcation, as in the limited variety, but gradually merges into the surrounding hepatized and œdematous lung-tissue.

Symptoms.—It often cannot be detected until it reaches the bronchus and is expectorated. When this occurs there is fœtid breath, cough attended with fœtid expectoration, and the sputa contain gangrenous sloughs of the tissue of the lung. The expectoration consists of three layers—a frothy superficial, a liquid stratum in the centre, and a thick sediment at the bottom. Chemically, it is found to contain fat, and fibres of elastic tissue are occasionally present in the black, tinder-like masses. The patient soon becomes prostrate. The face is pinched and livid, and death takes place from asthenia or putrid fever. In a few cases the disease lasts for some time. Hæmorrhage, which may exhaust the patient, is liable to happen in such cases.

Treatment.—Very little can be hoped for from treatment; the patients generally die. Nourishing diet, wine, and other stimulants are, of course, indicated. The inhalation of turpentine and creasote will help to diminish fœtor, and may possibly check the spread of the gangrene. The inhalation of a solution of carbolic acid 2 to 4 per cent., used two or three times daily by means of a spray apparatus, is recommended by some authorities, and the same remedy may be given internally, care being taken to avoid the production of symptoms of poisoning. The indications to be fulfilled are: the [illegible] of the diseased portion of the lung, the facilitating the formation of a line of demarcation, and of the detachment and expectoration of the gangrenous tissue.

lobules. It may also result from the extension of inflammation from the minute bronchi to the air-cells, or from the entrance into the air-cells during inspiration of the inflammatory products of the bronchial tubes, such products irritating the air-vesicles and producing inflammation. During collapse of the lung the air-cells do not contain air, the capillaries of the alveolar walls are liberated from the pressure of air upon them, and they become hyperæmic. The hyperæmia after a time ends in proliferation of cells and transudation of fluids. Closely allied to lobular pneumonia is another variety known as *disseminated pneumonia.* This is due to the obstruction of small branches of the pulmonary artery by emboli or thrombi, as may occur in the course of pyæmia. Catarrhal or lobular pneumonia, when it occurs, has a rapid tendency to run on to suppuration or even to gangrene, and the affected part is frequently the seat of hæmorrhage. In weak and elderly persons, in those suffering from acute or chronic diseases, or exposed to impure air, it is extremely common. In children it often occurs as a complication of measles, whooping-cough, and diphtheria. In these affections bronchitis and pulmonary collapse are common, and often end in catarrhal pneumonia.

Post-mortem appearances.—The inflamed lobules are scattered through both lungs, being most abundant towards the bases and along their lower free border, and also towards the surface. They are firm and wedge-shaped, with the base outwards and somewhat projecting beyond the surface, where each lobule forms the centre of pleural exudations. They are friable and break easily under the fingers. On section they are at first of a bluish-red colour; later on, when transudation and cell growth increase, they are light or greyish. The surface on section is smooth and homogeneous, but never granular as in the croupous variety: pressure forces out opaque fluid, at first bloody and containing abundant cells, subsequently pale grey and containing cells in a state of fatty metamorphosis. They are also mixed with pus and mucous corpuscles. In cases due to collapse, the inflamed lobules are most abundant towards the bases and along their lower free border. They are of a deep scarlet colour; they are voluminous and resistant, and form knots of irregular form and size: on section a tenacious secretion oozes out, often mixed with pus. All these changes are similar to what occurs in cases of red hepatization and purulent infiltration, but in this form there is cell growth instead of fibrinous exudation. The affected portion in many cases readily sinks in water. There is a tendency to the development of bronchitis, and to the effusion into the small bronchial tubes of a viscid sanious fluid. The effusion undergoes coagulation, and thus forms casts in catarrhal varieties the consolidations may be simply intra-alveolar, and contain within them (*a*) fibrinous exudation, (*b*) numerous leucocytes (migrated from the vessels), and (*c*) accumulations of large epithelial cells. In chronic inflammation of the lung the consolidation consists of products giving rise to infiltration and thickening of the alveolar walls (with small cells), to thickening and infiltration of the minute bronchi, and to an increase of the interlobular connective tissue.

All these various products are often found associated in advanced cases, and are met with in varying degrees in different stages of phthisis. The intra-alveolar exudation, *chemically* considered, consists of albumen, fibrin, phosphates, and carbonates. *Physiologically* considered, it is a constituent of the inflammatory process (croupous and catarrhal), and contains, besides fibrinous exudation, a large number of cell structures enclosing leucocytes. The quantity of the *fibrinous effusion* varies with the intensity and nature of the inflammatory process and with the susceptibility of the tissue involved. It is most abundant in acute cases, and where the tissues are weak, where the lung has a loose structure, and where its vessels are least supported. In the ordinary pneumonic form of phthisis this is the only morbid change; it is generally limited to circumscribed tracts of lung-tissue. In some cases there is, in addition, slight thickening and infiltration of the alveolar walls, due to the development of small-celled lymphoid tissue. In other respects the alveoli are little altered. In most acute (pneumonic) cases, the intra-alveolar exudation products undergo further changes. They are considerably altered and degenerated. The alveoli are destroyed, and every trace of lung structure is lost, a sort of granular *débris* being left behind. In such cases both lungs are rapidly consolidated and rapidly destroyed, and the disease generally occupies the base of the lung. The consolidations undergo disintegration, and cavities are formed. Such cases end fatally in a very short time.

Epithelial cells form another important constituent of the exudation. These are derived from the proliferating epithelial elements of the alveoli, or of the smaller bronchi. Their accumulation is most commonly met with within the alveoli; and the masses consist of large nucleated cells, filling the alveolar cavities. They may extend to the alveolar walls and infiltrate them, or may invade the interlobular connective tissue, and they may even spread into the tissue between the smaller bronchi. These cells are the products of the inflamed alveoli, and their presence leads to nutritive changes in the lung-tissue. In acute cases, or where the inflammation is most intense, or where the susceptibility of the lung-tissue to inflammation on the slightest provocation is very great, these young epithelial cells rapidly increase in number and change their form, but they frequently undergo degeneration and die. In chronic cases, the epithelial cells undergo an imperfect development, and form a new fibro-nucleated growth. The cells are round in shape and considerably larger than the leucocytes. They are markedly granular, and sometimes contain black pigment. The pressure they exert upon the alveolar walls interferes with the nutrition, and the same influence upon the alveolar vessels leads to their obliteration or destruction.

Leucocytes.—The migration of leucocytes is a necessary feature in inflammation. This is due to some alteration in the nutrition of the walls of the blood-vessels, and in inflammation of the lung (phthisis) the vessels supplying nutrition to the alveoli are particularly weak, and the escape of leucocytes is very prone to occur.

Subsequent changes. The alveolar growth.—Consolidation is followed by infiltration and subsequent weakening of the alveolar wall by small-celled tissue. This occurs in chronic inflammation, and is known as inter-alveolar growth. This change is often met with in the lung in phthisis. It may be observed round the smaller bronchi, where it is associated with intra-alveolar exudation. The alveolar growth is also associated with the development of epithelial cells, some of which are generally large and known as giant-cells. Many of them change their form, and are spindle-shaped, and often more or less branched. This alveolar growth is the most important. It consists at first of small lymphoid cells, subsequently of cells which, varying in form, give rise to a firm fibro-nucleated structure. Thus this growth resembles adenoid or fibroid tissue growth. In some parts of the lung this peculiar growth may be found to have obliterated the air-vesicles, the place of which is occupied by a fibro-nucleated structure. This growth is generally non-vascular. By its pressure it partially or completely obliterates the pulmonary capillaries situated in the vicinity of the indurated tissues. It thus interferes with the inflation of the air-vesicles, and also impedes the pulmonary circulation. The alveolar growth readily undergoes degenerative changes, and thus a *débris* associated with degenerated epithelial cells, and known as a caseous degenerated product, is often formed. It also undergoes other forms of disintegration. Thus, in acute cases the thickened alveoli break down rapidly and disintegrate. In a less severe form the alveolar walls are destroyed, and their place is taken by a thickened and newly-developed imperfect fibro-nucleated tissue.

Increase in the interlobular connective tissue.—This is a structural change which occurs in connection with consolidation. It is most commonly and chiefly met with in phthisis. This growth is most abundant in the tissue round the bronchi and surrounding the blood-vessels. It is also continuous with the peri-alveolar tissue, and thus it infiltrates and thickens the alveolar walls. In chronic phthisis this tissue growth is most marked. It is highly cellular, and resembles the adenoid cell structure round the alveoli. In advanced cases, it is more readily developed into perfect fibroid tissue. It is less prone to degenerative or caseous changes than the non-vascular inter-alveolar growth. It has a tendency to give rise to induration of the consolidated portion of the lung, with subsequent contraction of the diseased structure. Very often the induration ends in or is associated with cavities. Such cavities are surrounded by tough fibroid walls. Other morbid changes are met with in the bronchi, pleura, and bronchial glands. Those met with where the smaller bronchi are involved are—1st, catarrhal, or those changes which interfere with the normal condition of the blood-vessels and the mucous membrane of the bronchi; and 2nd, the cell-infiltration which involves the deeper structures, and also the peri-bronchial tissues. (*a*) The *catarrhal change* is most commonly met with in all forms of phthisis. In acute cases the catarrh is limited to the apex, is very protracted, and gives rise to abundant secretion, rich in small cell-elements. The mucous membrane is highly vascular.

(*b*) *Cell-infiltration.*—This change occurs chiefly in scrofulous subjects and in long-standing or chronic cases. In it the bronchial walls are implicated, the sub-epithelial and peri-bronchial connective tissue is infiltrated with large-sized cell-elements. The bronchial mucous membrane is thick and opaque. There is proliferation of lymphatic follicles, which are situated in the walls of the lymphatic vessels, or between the bronchi and the pulmonary artery. The infiltration often extends to the lobules. The bronchi are reduced in size and the adjacent ones dilated.

Terminations.—The morbid process may end in resolution, but this is a rare termination. In it the lesion disappears. This termination is mostly noticed in cases of intra-alveolar effusions. In such cases, owing to a copious supply of blood-vessels, the exuded materials liquefy. The young cells undergo complete fatty degeneration; they are destroyed and removed by absorption or by expectoration. In such cases some portion of the consolidated material which infiltrates the alveolar wall yet remains. The circulation is gradually restored. Another termination is an imperfect development or hypertrophy of portions of the lung tissue. It is known as induration, and is a somewhat common result. In it the night sweats. There is no fever. The physical examination of the chest reveals continuance of dulness on percussion, and bronchial breathing. The absence of fever excludes the idea of cheesy infiltration. The disease is chronic and may be prolonged for years, and the symptoms then relate to those conditions which complete the disorder, when the induration begins to contract, and the thorax to sink, and the bronchi begin to dilate. *Local.*—When a large portion of the lung is diseased there is progressive dyspnœa, due to the obstructed circulation in the nodulated or indurated lung. Dyspnœa increases on exertion, during winter, and with bronchial catarrh. There is dragging pain about the sides. In advanced cases the fits of coughing are attended with profuse muco-purulent or purulent expectoration containing moulds of dilated bronchi and caseous plugs; it may be fœtid or black as in miners.

The cough is due to the irritation of the bronchial walls by the putrid secretions. The walls of the bronchiectatic cavities are dilated, and therefore tolerably insensible, and they are less subject to irritation. It is only when the secretion reaches the neighbouring bronchi that fits of coughing occur. Thus, in these cases of bronchial dilatation after fits of coughing the patients enjoy intervals of repose, during which time they also expectorate very little. The expectoration is often putrid, and this change may be due to its retention within the tubes. This is owing to the bronchiectatic cavities being generally situated at the base or in the lower lobes of the lung. The contents of the tubes from these parts cannot be so readily ejected as when the dilatation is situated at the apex where, owing to the anatomical arrangement of the bronchi (obliquely downwards), the contents are easily expectorated. The expectoration is also peculiar. It is at times purely catarrhal, and at times contains enormous quantities of putrid pus. The obstruction to the pulmonary circulation leads to hypertrophy and dilatation of the right side of the heart, and this is followed by cyanosis, congested liver, and sometimes by general anasarca. In far-advanced cases lividity of the surface, puffiness of the face and clubbed fingers, as in cases of persistent cyanosis, are common. The pulse may be normal at first, but soon becomes rapid and irregular. There is more or less hectic fever with some elevation of temperature, and also loss of appetite, vomiting, and diarrhœa.

Complication.—Bronchiectasis is thus explained. In this inflammation, part of the lung being diminished, the chest-wall, to fill up the space, gives way as far as it can, but its hard structure limits its power of contraction, and therefore the bronchus has to give way to atmospheric pressure. The attacks of coughing also increase the pressure upon the relaxed bronchial walls.

Physical signs.—These are mostly due to bronchiectasis, and to the indurated lung having undergone contraction. Where the bronchiectatic dilatation is near the surface, on inspection we find the affected side is considerably depressed and its movements impaired. *Percussion.*—There is marked increase of resistance, owing to consolidation of the pulmonary substance about the cavity, and absence of perfect resonance, or there is complete dulness. *Auscultation.*—If there has been no cough for some time there will be suppression of or feeble breath sounds, sibilant, sonorous, and moist indistinct râles. After cough there will be bronchial or cavernous breathing, and various râles in the dilated bronchi; if the cavity be deep there will be no physical signs as the cavity is surrounded by healthy lung. The heart is displaced towards the diseased side and the liver is drawn up.

Diagnosis.—The disease may be mistaken for consumption. In acute tubercular phthisis the course is extremely rapid, the fever high, and emaciation and debility more marked. In induration the cavities are emptied with great difficulty, the sputum is fœtid, and if left to stand it separates into three layers, the upper frothy, the middle whitish-grey, and the lower one a sediment of a greenish-grey colour; cough occurs in violent paroxysms and at wide intervals. If putrefactive decomposition of the secretion takes place, the expectoration will contain crystals of the fatty (palmitic and stearic) acids. These are seen under the microscope to consist of long, slender, colourless needles, lanceolate in form and generally straight, though sometimes curved. They may be single or grouped in tufts. They are freely soluble in chloroform or ether, and are thus distinguishable from fragments of elastic fibres, which, when curved, they somewhat closely resemble. In *bronchiectasis* there is no fever, the secondary disease of the larynx and of intestines is very rare, and emphysema is very common.

The *prognosis* of chronic interstitial pneumonia depends upon the nature of the primary affection which led to the disease. When it accompanies tuberculosis the prognosis is very grave; when due to chronic bronchial catarrh or emphysema the progress is tedious, and death often takes place by asthenia due to marasmus and dropsy. In a few cases death is due to hæmorrhage from the walls of the cavities.

Treatment.—The disease is often met with in an advanced stage of some other primary disorder, and is therefore often beyond the reach of any treatment. The cause, or the primary disorder, should be treated, and, if possible, its further ravages should be checked. The chief aim consists in preventing any other fresh complication. Attention to the improvement of general health is especially necessary. For this purpose nourishing diet and tonics are indicated.

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Leucocytes.—The migration of leucocytes is a necessary feature in inflammation. This is due to some alteration in the nutrition of the walls of the blood-vessels, and in inflammation of the lung (phthisis) the vessels supplying nutrition to the alveoli are particularly weak, and the escape of leucocytes is very prone to occur.

Subsequent changes. The alveolar growth.—Consolidation is followed by infiltration and subsequent weakening of the alveolar wall by small-celled tissue. This occurs in chronic inflammation, and is known as inter-alveolar growth. This change is often met with in the lung in phthisis. It may be observed round the smaller bronchi, where it is associated with intra-alveolar exudation. The alveolar growth is also associated with the development of epithelial cells, some of which are generally large and known as giant-cells. Many of them change their form, and are spindle-shaped, and often more or less branched. This alveolar growth is the most important. It consists at first of small lymphoid cells, subsequently of cells which, varying in form, give rise to a firm fibro-nucleated structure. Thus this growth resembles adenoid or fibroid tissue growth. In some parts of the lung this peculiar growth may be found to have obliterated the air-vesicles, the place of which is occupied by a fibro-nucleated structure. This growth is generally non-vascular. By its pressure it partially or completely obliterates the pulmonary capillaries situated in the vicinity of the indurated tissues. It thus interferes with the inflation of the air-vesicles, and also impedes the pulmonary circulation. The alveolar growth readily undergoes degenerative changes, and thus a *débris* associated with degenerated epithelial cells, and known as a caseous degenerated product, is often formed. It also undergoes other forms of disintegration. Thus, in acute cases the thickened alveoli break down rapidly and disintegrate. In a less severe form the alveolar walls are destroyed, and their place is taken by a thickened and newly-developed imperfect fibro-nucleated tissue.

Increase in the interlobular connective tissue.—This is a structhe lung-tissue is changed into a bluish-green colour, is moist, and fœtid, is abruptly limited, and the line of demarcation is surrounded by œdematous or hepatized lung-tissue. At first the gangrenous spot is tolerably firm, but soon decomposes into a thickish, dark liquid, mixed with rotten *débris* of the tissue. The liquid slough may discharge through a bronchus, setting up bronchitis; it rarely empties into the pleural cavity or into the surrounding cellular tissue. In some cases the gangrenous portion of the lung is expelled, and a fibrous capsule forms, with a cavity containing healthy pus, and which may ultimately close up and cicatrise. In a few cases gangrene of the pleura is associated with the disease in the lung. In the diffuse form the entire lobe of the lung is frequently gangrenous, its parenchyma is decomposed, and is converted into a pulpy, black, moist substance; it does not present any line of demarcation, as in the limited variety, but gradually merges into the surrounding hepatized and œdematous lung-tissue.

Symptoms.—It often cannot be detected until it reaches the bronchus and is expectorated. When this occurs there is fœtid breath, cough attended with fœtid expectoration, and the sputa contain gangrenous sloughs of the tissue of the lung. The expectoration consists of three layers—a frothy superficial, a liquid stratum in the centre, and a thick sediment at the bottom. Chemically, it is found to contain fat, and fibres of elastic tissue are occasionally present in the black, tinder-like masses. The patient soon becomes prostrate. The face is pinched and livid, and death takes place from asthenia or putrid fever. In a few cases the disease lasts for some time. Hæmorrhage, which may exhaust the patient, is liable to happen in such cases.

Treatment.—Very little can be hoped for from treatment; the patients generally die. Nourishing diet, wine, and other stimulants are, of course, indicated. The inhalation of turpentine and creasote will help to diminish fœtor, and may possibly check the spread of the gangrene. The inhalation of a solution of carbolic acid 2 to 4 per cent., used two or three times daily by means of a spray apparatus, is recommended by some authorities, and the same remedy may be given internally, care being taken to avoid the production of symptoms of poisoning. The indications to be fulfilled are: the disinfection of the diseased portion of the lung, the facilitating the formation of a line of demarcation, and of the detachment and expectoration of the gangrenous tissue.

inflammatory process does not subside, and the exudation products are not absorbed. There is continued infiltration, and the infiltrated alveoli become more thick. The consolidated material changes its form and becomes fibrillated. This condition may remain for a time, but generally the lung-tissue or the infiltration disintegrates. Caseation often occurs in scrofulous persons, in whom the cell-infiltration of the alveolar walls and the cell-growth in the smaller peri-bronchial tissue, with subsequent destruction of the lung always occur. In these cases, owing to the pressure of the intra-alveolar growths upon the capillaries of the lung, the circulation of blood is interfered with, and as a result the intra-alveolar products are not absorbed. The alveoli are deprived of their nutritive fluid and are destroyed. The accumulated products within the alveoli, pressing upon the capillaries of the lung, lead to the stagnation of blood within them, and to further defects in the circulation in the lungs, with subsequent disintegration. Where the cheesy infiltration gradually becomes more and more dried up and atrophied it forms detritus. The granular matter and other organic substances contained within the caseous products disappear, and a sort of calcareous mortar-like concretion remains. It very often happens that the shrunken cells, which have become caseated, liquefy and are expectorated. In such cases the new growth leads at first to fibroid induration, and the lung tissue is replaced by the connective tissue growth. In subsequent stages, owing to the pressure of the inflammatory exudation on the alveolar walls, and also on the interlobular connective tissue, the vessels are obliterated, and there is caseation ending in cavities, or the tissue becomes thickened. The tissue growth subsequently disintegrates.

Caseation.—It is a retrograde metamorphosis. In it the consolidation products become shrivelled and dried, and are converted into a soft, yellowish, cheesy material, containing shrivelled cells of the original deposit, fatty and other *débris*, and crystals of cholesterin. In constitution it resembles yellow infiltration and yellow tubercle. The caseous masses are chiefly found in chronic cases, and in the apices of the lungs, and also near the old cavities. This caseation is due to the non-vascularity of the tissue growth, the pulmonary vessels being obliterated by the pressure of the proliferated epithelial cells within the alveoli, and the infiltrating cell growth. In long-standing cases these caseous products are often found to have become encapsuled by a layer of fibroid tissue growth. As a further process, caseation frequently undergoes softening and liquefaction, and the caseous products are expectorated. In cases where the inflammatory process is slow and insidious, caseation is most common.

These caseous matters are frequently met with in various organs of the body, but the lung is their most common seat. Much confusion has arisen as to their nature and origin in the lungs. It was formerly the habit to regard all cheesy masses as of a tubercular nature and origin. It is quite true that tubercle often does undergo this change, fatty degeneration being a preliminary stage, but it is by no means true that all cheesy matters are the result of the metamorphosis of tubercles. They are, on the contrary, one of the last stages of the degeneration of a large number of histological elements, and are not characteristic of any particular morbid growth. In addition to softening and liquefaction caseous growths sometimes become calcified.

Fibrosis.—As another sequel of exudation, contractile processes sometimes occur in chronic inflammatory cases, and affect the peribronchial tissue. The process extends, and involves the alveolar walls, and fibrosis results. In chronic cases, or where the disease is limited to circumscribed portions of the lung, the consolidations are fibrous, the lungs are considerably reduced in size, and the caseous masses are encapsulated. In such cases, if fresh inflammation is set up, the consolidations undergo further changes giving rise to ulceration and formation of large cavities in the lung. The lung in other places presents a tough and hard structure resembling cartilage. The cause of these secondary changes and ulceration may be assigned to the setting-up of fresh irritation, due to the retention of infiltration products and to an increase of the bronchial secretion. These, with other fresh changes, lead to destruction of the bronchial and alveolar walls and of the surrounding indurated lung tissue. The formation of cavities is a very frequent result. These are found in the lung, in the advanced stage of pulmonary phthisis. They are due partly to the breaking-down of the lung tissue when in a state of cheesy infiltration, and partly to fresh irritation of the degenerated cells. The destruction takes place in a few or many points. In acute phthisis, the destruction of the lung is extensive, and although a portion of the infiltrated products may be coughed up, some still remain in the diseased parts as a source of fresh irritation, and sooner or later the diseased lung tissue breaks down and infects the system.

With regard to the size of the cavities, this varies in different cases, and in the same case in different portions of the lung. They are often of large size. In some cases, their progress is checked and they cease to extend. In a majority of cases and those of long standing, the cavities, after remaining quiescent for a time, rapidly extend. Large-sized cavities are generally due to the coalescence of several smaller ones, or to the extension of soft centres. In a few cases the consolidation becomes uniformly caseous, the caseous mass soon begins to soften and disintegrate in the centre and gradually liquefies throughout. Thus an extensive cavity, communicating through a bronchus with the external air, may be formed.

The further course of these cavities varies: (1) they may not extend, but continually secrete pus as in chronic abscesses; (2) the cavity may extend by caseation and ulceration in its walls and blood-vessels may be exposed; or (3) they may become quiescent, and after a time either extend or become obliterated. The continually secreting cavities are those which are in a state of progressive ulceration. The quiescent cavities, after exposure to cold weather or to other injurious influences, generally take on very unhealthy action and begin to extend; (4) the cavities may cicatrise and shrink up into irregularly shaped fibrous sacs, containing chalky matter.

II. *Tubercle.*—Two varieties of tubercle are often met with in phthisis in the lungs. They often coexist in the lung of the same individual. This co-existence is supposed by some to be due to the tendency to pass from one into the other. In many cases, however, we find the presence of one or the other form exclusively. They are known as the grey granulations, or miliary, and the yellow or crude tubercles. The *miliary* variety varies considerably in size and appearance. They may be as big as a hempseed or only equal to a pin's head or millet seed. At first they yield to firm pressure, and they are grey and translucent in appearance. After a time they become hard and cartilaginous, owing to their losing moisture, or are converted into the yellow variety owing to caseation. In shape they are generally spherical and present a well-defined outline. In the lung they are met with in clusters and as disseminated nodular growths implicating the lung stroma. They may occur in these forms in any part of the lung. In very acute cases they are uniformly spread throughout its whole texture. Their most favourite seat is the apex of the lung, in which part they are chiefly or primarily developed. In those cases where the whole lung becomes involved, they are always most numerous in the upper lobes and in the most posterior parts.

Yellow tubercle.—These are larger than the miliary variety and vary in size from that of a pin's head to that of a walnut or even of an orange. They are granular, soft, amorphous, and pulpy, and are yellow and opaque in appearance and irregular in shape. They are the commonest form of tubercle. In the lung when they exist as nodules, they occupy a larger space than the grey variety;

even a lobe may become infiltrated by them. They are generally found associated with the grey form, and they occur in groups, and may attain a very large size, partly as individual growths and partly by coalescence. They are mostly found in chronic pneumonic cases, and they originally develop in the interlobular connective tissue which goes to form the fibrous stroma; they also surround the sheaths of minute vessels and may be found in the tissue surrounding the smaller bronchi. These exercise great pressure on the lung tissue, depriving it of means of nutrition, and causing death of the part by caseation.

Under the microscope, both these growths present elements of lymphatic tissue, proliferation of lymphatic cells, and the delicate stroma (reticulum) of the connective tissue. Under inflammatory processes they present three kinds of structure: 1. During the catarrhal irritation, or during the early stage of their development, the nodules consist of intra-alveolar accumulations, of an aggregation of the adenoid or the lymphatic cells with a single nucleus, some leucocytes, and of granular materials. The adenoid cells are characteristic. They are large, multinucleated, and fusiform or stellate in form. They are modifications of the proliferated epithelial cells and of the swollen epithelium within the alveoli, as met with in pneumonic cases. The granular matter which the nodule contains is supposed to be the product of degenerative changes taking place in the epithelium, or an exudation from the blood-vessels. 2. Another structural change which tubercular nodules undergo during the inflammatory process is the alveolar accumulation associated with intra-alveolar infiltration and thickening. This change is mostly observed in the advanced stage of acute tuberculosis. In this change the adenoid cells are less numerous; they are round and lymphoid; they are also small and contain two or more nuclei. The nodules also very often contain giant-cells. These latter are at first to be found only at the peripheral portion, the centre being occupied by small celled elements and granular matter. 3. In the third variety, the nodule consists of a reticulated structure, associated with large or giant-cells. In this form, the thickening of the alveoli is most marked. The alveoli contain within them giant-cells with eighteen or twenty nuclei and nucleoli; each cell when examined being found to consist of a mass of granular protoplasm. It is of a spheroidal shape and an irregular outline. These cells are supposed to originate from the proliferation of the alveolar epithelium. They may also be derived from the cells of connective tissue, and from the endothelium of the blood-vessels and lymphatics. During their development they increase in size and send out branched processes which are continuous with the reticulated and indurated surround-who has died of phthisis, we generally find the emaciation extreme. The skin appears too loose for the body, there is no fat, and the muscles are atrophied. The face is cadaverous, the cheek-bones prominent, the nose pointed. The ends of the fingers are clubbed, the feet are often œdematous. Mechanical changes similar to those noticed on physical examination during life are observed in the chest wall. On opening the chest, the power possessed by the lung of resistance to local expansion is found to be increased, and the organ therefore does not recoil as in health. In the case of pure tubercular or pure pneumonic phthisis, the parenchyma of the lung presents varied and numerous alterations. In advanced cases the lungs are devoid of vesicular tissue. There is consolidation of the lung in every stage of deposition, and infiltration by various kinds of growth and exudation. The lungs also present signs of softening and cavities of various sizes, the space occupied by the diseased portion of the lung is diminished, and the pleural covering is thickened.

With regard to the seat of consolidation, whether due to the pneumonic or the tubercular process, or to both processes combined, this pulmonary lesion is most marked at the apex. It may also be found throughout the upper lobe; consolidation in the lower lobe is rare; the consolidation varies in character and is seen in various stages. It is often more extensive in one part. It may be purely inflammatory, of red hepatisation, and limited to intra-alveolar accumulation, or may be pneumono-tubercular, and present nodules and other growths. Sometimes the changes are retrograde in one part and extending or progressive in another. Generally both lungs are involved, although the consolidation may be limited to one lung, and the opposite lung may be quite free from disease. In mild cases the disease is limited to the lobules, or may be slowly extending to other parts of the lung.

Condition of the lung as seen by the naked eye.—Where the disease is limited to the intra-alveolar accumulation, the affected portion of the lung tissue is soft, pulpy, and friable, breaking down readily under the finger. The diseased lung usually presents a uniform appearance; it seldom has a lobulated outline. At first the colour is dark brown, owing to the pressure of exudation upon the blood-vessels, but where the fatty degeneration is far advanced the colour of the lung is changed to yellowish grey, with here and there deep yellow portions of caseation scattered throughout the lung substance. In such cases, if the alveoli are destroyed or where cavities exist, the vomicæ are soft and friable and the walls present an irregular outline. They are generally surrounded by congested or œdematous lung tissue, and lined with a smooth delicate membrane. In those cases where the disease is secondary to broncho-pneumonia, the where the inflammatory process is slow and insidious, caseation is most common.

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With regard to the size of the cavities, this varies in different cases, and in the same case in different portions of the lung. They are often of large size. In some cases, their progress is checked and they cease to extend. In a majority of cases and those of long standing, the cavities, after remaining quiescent for a time, rapidly ing tissue growth. In this way the reticulum containing in its meshes epithelial elements is produced round the giant-cells. At the same time, the small lymphoid cells which infiltrate the alveolar walls also begin to develop, and thus form the nucleated reticulum which resembles adenoid tissue. All these nodular growths are non-vascular.

These three kinds of changes are often combined in one nodule, or a nodule may consist only of one or the other of these structural elements. Like the pneumonic processes these tubercular changes vary in degree; they depend upon the intensity of the tubercular processes, and upon the state or susceptibility of the tissue involved. The differences in the textural changes and in the condition of the nodules are also due to the intensity of the infection.

Secondary changes.—Like pneumonic consolidation, the tubercular nodules undergo secondary retrograde or degenerative changes. These vary in extent in each case. In acute tuberculosis the degenerative changes are more marked. The alveoli rapidly become disintegrated and death occurs in the early stage of the process. In milder cases, the metamorphic degeneration is slow; the nodules remain undisturbed as simple intra-alveolar accumulations, till at a later period, or after the development of giant-cells and reticulum, the degeneration or necrosis takes place. There is increased development of adenoid tissue and the epithelial elements form giant-cells. The degenerated nodule, if examined, will be found to consist of a central portion, containing granular *débris* and fibro-nucleated structures, and of a peripheral portion, which forms fibroid tissue. In the extreme centre there are thickened alveoli infiltrated with adenoid growth. In chronic cases, however, the secondary changes are still less marked; the giant-cells and other branched cells are developed, and, with the intra-alveolar contents (epithelial cells and fibrinous exudation) are converted into fibroid indurated tissue and ultimately degenerate into fibrillar substance.

Cheesy degenerative change.—From what has already been stated with regard to tissue changes in the lung, as due to primary inflammatory processes, and to the presence of tubercles from the first, it may be surmised that the changes are always alike. In both, these degenerative changes are due to imperfect vascular supply. In the early stage of the process of infiltration the capillaries are rendered impermeable owing to the pressure of the alveolar contents upon the alveolar walls. In the later stages of infiltration, the obliteration of the pulmonary vessels is due to the proliferation of their endothelium and to the low vitality of the new elements. The absence of new formation of vessels in the fibro-nucleated in the bronchi which go to form part of the diseased apex. In such cases, the apex being the least supported, during cough there is increased air-pressure upon this portion of the lung. The air-cells being obliterated by morbid products, the expansion of the chest walls acts only in dilating the tubes. Again, the lung tissue in phthisis being contracted in various directions, dilatation of the imbedded bronchi is a common result. Emphysema of a patch of lung around the diseased portion often occurs in phthisis. It chiefly occurs when a portion of the lung is cut off from the air-supply. This is common in cases of tubercles and in cases of lung lesion due to the accumulated morbid products within the alveoli.

Pneumothorax.—This is rare, and is sometimes only a temporary condition. The aperture is soon closed, and the air within the pleural cavity becomes absorbed. It occurs from the breaking down of the pulmonary tissue, and the formation of cavities situated on the surface of the lung. The pleural cavity may contain air and fluid effusion, and communicate with a bronchus. The gas may be a product of simple exhalation from the pleura or of decomposition of a fluid communicating with the external air. The rupture may be due to the breaking down of the texture of the pleura. In the phthisical cavities this change is very rapid; it does not give time for the adhesion of the pleura with the lung substance. The pleura therefore becomes soft and very readily yields to very slight pressure of air, as during coughing. Rupture may occur at any period of phthisis; even a small tubercle close to the pleura may itself soften down and lead to perforation. In advanced cases a phthisical cavity is a most common cause, and rupture is most common on the left side. In acute cases rupture also occurs.—In miliary tuberculosis, the bronchial, cervical, and mesenteric glands become enlarged and undergo various degenerative changes, viz. caseation and calcification. The peritoneum, the arachnoid, and even the pericardium become affected with tubercles in many cases of acute tuberculosis.

With regard to lesions of other organs in cases of phthisis, the most important perhaps is ulceration of the bowels. This is a most common complication of phthisis.

In it there is at first catarrhal inflammation, leading to swelling of the gland-follicles of the small and large intestines. There is proliferation of the cells in the submucous tissue, followed after a time by caseous degeneration ending in destruction and discharge of the degenerated products, leaving ulcers behind. Some have supposed that the tubercles or the infection begin in the lymphatic tissue and thence spread. The granulations are often connected the constitution. The inflammatory products have a tendency to degenerate. They are characterised by the growths of cells too large to be absorbed by the lymphatics. Their accumulation presses upon the blood-vessels and leads to defective nutrition of the tissues which they supply. Tubercle in the intestine is common in scrofulous children; in these patients, intestinal catarrh with cheesy degeneration is frequently observed.

In whichever way the tubercles may have developed, the first change they produce in the lung is the formation of the adenoid tissue in the alveolar walls and round the sheaths of the vessels and lymphatics. Owing to the complex mechanism of the lung, the inflammatory products and the degenerated epithelial cells are retained, the lung being richly endowed with absorbents, which readily take up those degenerated products and distribute them through the lungs and small bronchi. Once developed, the tubercle becomes a source of great infection. It acts as a specific irritant and thus sets up inflammation of the alveoli, leading to nodular growths. These growths undergo various changes and ultimately lead to ulceration and formation of cavities, or, as in favorable cases, they degenerate and become converted into an inert mass, and may remain encapsulated in a fibrous envelope. Thus the tubercle is supposed to be a growth which has secondarily developed from caseous degeneration, either in the lung or in any other part of the body. Its distribution varies according as the infective particles are carried along the blood-vessels or the lymphatics. By the lymphatics it is taken up in a minutely divided condition, and either arrested in the lymphatic glands, or carried on into the blood to be deposited into the intestine, larynx, &c.

Phthisis is divisible into two main forms, acute and chronic, each varying in its clinical phenomena, in its duration, and prognosis. Both are forms of the same disease, and have the same pathological connections.

Acute Phthisis.—This form is divisible into acute tuberculosis; acute pneumonic phthisis or scrofulous pneumonia; and acute tuberculo-pneumonic phthisis.

(1) *Acute tuberculosis*, otherwise known as acute tubercular phthisis. This form is the rarest. In this affection the lungs are uniformly studded with tubercles (miliary) from the apex to the base. The tubercles develop first in the bronchial membrane; these then spread downwards and infect the alveoli. At the same time there is also some existing infection or tubercle, somewhere in the body, as on the surface of the pleura, in the intestines, liver, or kidneys. The infection exists in the form of cheesy matter. Miliary tubercle is that which has not begun to caseate; it may

cause death before suppuration has been set up. The tubercle exists in some part of the body, and may be carried by the blood and deposited in the lung. The disease has a tendency to extend and involve the unaffected lung and also the larynx and intestine.

Theories with regard to tubercles.—Two theories have been invented to account for the appearance of tubercles in the lung. (See vol. i, page 260.) The school of Laennec maintained that the diathesis is the sole cause of tubercle, while the school of Niemeyer believe tubercle to be a mere product of inflammation—

Grammatici certant et adhuc sub judice lis est.

A tendency to tubercle is undoubtedly hereditary. Acute tuberculosis often occurs in children, and oftener before the middle of life than after it. It sometimes sets in after acute diseases, though the chronic or suppurative form is more common.

The most recent theory with regard to the origin of tubercles has been briefly referred to in a previous page. (See vol. i, page 261.) The discovery by Dr. Koch of bacilli in the expectoration of consumptive patients, and in the cheesy and tuberculous masses, has led to the belief that these micro-organisms are the cause of the disease. Dr. Koch's process for discovering the bacilli has been already described; the all-important question is as to their connection with tuberculosis.—Are they the cause, the consequence, or only an accidental accompaniment of this disorder? Very conflicting opinions are held on this subject. It seems expedient to give a short account of Dr. Koch's early researches and of his opinions formed thereon.

Having examined the organs of many animals, including men, known to have died of tubercle, or which, having tubercle, had been killed for experimental purposes, and having found that the bacterium which we now call the bacillus of tubercle was invariably present in greater or less numbers, Koch came to the conclusion that this organism is the constant associate of the tuberculous process. He next set before himself the task of endeavouring to ascertain the exact relationship of the bacillus to the tuberculous process. With that object in view he began a series of cultivation experiments. He sowed some tuberculous tissue in a little of the blood-serum, prepared in a certain way, of the ox and of the sheep. The tuberculous morsels thus sown were removed, with every possible precaution against contamination, from the bodies of animals, man included, dead of tubercle. As a result of the experiments, Koch believes that he has proved that this bacillus of tubercle is not only the associate of tubercle, but that it is the actual virus of tubercle. The last of these two conclusions is, of course, of vast importance the constitution. The inflammatory products have a tendency to degenerate. They are characterised by the growths of cells too large to be absorbed by the lymphatics. Their accumulation presses upon the blood-vessels and leads to defective nutrition of the tissues which they supply. Tubercle in the intestine is common in scrofulous children; in these patients, intestinal catarrh with cheesy degeneration is frequently observed.

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An elaborate series of recent experiments by Mr. Watson Cheyne, carried out upon the lines laid down by Koch, confirm Koch's work on tubercle, and even carry the subject beyond the point at which he left it.

Few subjects have raised more discussion amongst medical men than that one which is introduced by the question, "What is tubercle?" Of the many answers which this question has received, probably none has attracted more widespread attention than that given to it by Dr. Koch's researches. Those who accept his teaching as true, must look upon every case in which the bacillus of tubercle is found, as tuberculous. During the last twelve months, there has been gradually accumulating a mass of evidence in favour of the view that this bacillus is the constant associate of tubercle. This evidence comes from observers in all parts of the world. Whether this organism is the cause of tubercle is another question; and it is not to be expected that men who have spent long years in the study of tubercle, and who have their own views about tubercle, will readily accept Koch's teaching as all true—unless, indeed, their own observations have already prepared them for the acceptance of such views. The subject will not rest where it is; every week will add more and more to the weight of the evidence which must, probably very soon, definitively settle the important question—Has Koch discovered the cause of tubercle? Should that question be answered in the affirmative, then every case in which the bacillus of tubercle is found, must be classed under the head of parasitic diseases; and in all discussion as to whether miliary tubercle, chronic phthisis, scrofula, perlsucht, &c., are tubercle, or whether each of them is a distinct disease, must end with the establishment of the fact that they are all due to the parasite which Koch has discovered.

The bacillus has been found not only in the expectoration and in the dead body, but in the breath of consumptive patients; in the urine, in cases of tubercular disease of the kidney; in the fæces, in cases of tubercular disease of the intestines; in scrofulous glands, ulcers, &c. It is found so constantly in the sputum of consumptive patients that its discovery may be held to decide the diagnosis in doubtful cases. It will also serve to distinguish cases of consumption from cases of bronchiectasis, and from others which present no specially characteristic signs. Cases have occurred in which the signs of pulmonary disease were absent or only very slight, and yet the expectoration contained bacilli. Later on signs of phthisis appeared and tubercular disease was demonstrated on post-mortem examination. It is moreover probable that the presence of bacilli in the sputum may be useful as regards the formation of the prognosis.

Another question connected with this theory, though not with it exclusively, refers to the infectiousness or otherwise of consumption. Different views are held on this question which will be again referred to when treating of the general causes of the disease.

Morbid anatomy.—The body after death from acute tuberculosis is usually somewhat wasted. The lungs are found stuffed with minute tubercles, and the same growths are found on the peritoneum, pericardium, and sometimes in the cerebral meninges; one of these growths, if examined with the naked eye, appears merely a greyish translucent mass of the size of a small pin's head. When placed under the microscope it is found to be situated in the lymphatic tissue of the lung. At its earliest stage it consists of an aggregation of lymphatic cells, each with a single nucleus, but very soon other cells, less numerous but larger and each containing two or three nuclei, appear, and with them a few very large cells with eighteen or twenty nuclei; these last are called giant-cells. After a time the contents of all three kinds of cells undergo a degeneration. The tubercle then loses its semi-transparent appearance and becomes opaque. Under the microscope it now exhibits a mere granular appearance. The temperature having been high, the spleen is usually enlarged. Sometimes the lymphatic glands, whether of the bronchi or of the mesentery, are caseous, to which the appearances already described under tubercular meningitis may in a few cases be added. Such are the post-mortem appearances of acute tuberculosis.

Symptoms.—Tuberculosis may occur in one of three forms:—
1. Insidious. 2. Acute febrile. 3. Adynamic.

1. In the insidious form, the patient at first complains of languor, restlessness, derangement of digestive organs, offensive stools, with rapid wasting, and fever. With these symptoms the tubercles begin to appear.

2. The acute febrile is known by repeated rigors (in the absence of exposure to malaria), high fever, and head-symptoms. The skin is pungently hot and temperature is also high.

3. The adynamic fever is associated with profuse sweating, great prostration, typhoid symptoms, and hurried respiration, &c.

In all these forms tubercles are noticed in certain structures, as the lungs, peritoneum, meninges. The patient is usually tall, slim, and erect, delicate looking, of a clear complexion, with large pupils, bright eyes; is precocious, clever in talking, and has learnt to walk soon; is very excitable and active in mind and body; the skin is thin and delicate, the veins easily perceptible, hairs fair and silky, eyelashes long. The ends of the bones are small and thick, shafts rigid and thin, cartilages soft and flexible, thorax small and flattened.

When acute tuberculosis occurs in an adult, the patient is attacked with high fever, and there is pungent heat of skin, rapid pulse, great restlessness, and various typhoid symptoms, as the coated tongue, deranged digestion, often diarrhœa and even delirium and other symptoms resembling enteric fever. After a time there is cough with some expectoration; rarely the sputa are hæmorrhagic. The patient often complains of slight pain in the affected part. As the case progresses, the fever-chart shows increased heat, the patient wastes rapidly, the cough continues, the breathing becomes more embarrassed, and the crepitations more distinct and louder. In very acute cases, the patient, after a few weeks, becomes more and more exhausted and dies collapsed.

Where the deposit of tubercle affects the meninges, symptoms of meningitis, with pain in the head, vomiting, and marked delirium set in; such patients often become comatose, due to effusion taking place, and die in that condition.

In every case there is the history of family predisposition, and, in most cases, the absence of hæmoptysis.

(2) *Acute pneumonic phthisis* otherwise known as scrofulous pneumonia, is a purely pneumonic form. The disease is most common. In this form the catarrhal pneumonic inflammation is the chief morbid process. Its characteristic feature is that the consolidation, instead of becoming absorbed as in other inflammations of the lung, runs on to various secondary changes and leads to

caseous degeneration. The disorganising processes soon lead to destruction of the lung tissue, and often to pneumothorax.

Pure pneumonic phthisis generally originates in inflammation affecting very small bronchi, the catarrh subsequently extending to the alveoli, where further changes in the exudation take place. It may also arise from bronchitis leading to pulmonary collapse and subsequently to phthisis. The disease mostly affects children, and particularly as a *sequela* of measles and whooping-cough. In these cases the progress is either rapid or slow, according to the state of the constitution and other surrounding circumstances. The children are generally weak and debilitated, and possess feeble powers of resistance against any injurious influences. They easily fall ill, and when ill slowly or never recover. In such cases we often find a previous history of cheesy and enlarged lymphatic glands in the axilla, mesentery, or neck, as mostly occurs in scrofulous girls, and it is due to hyperplasia of cell-elements. There may also be a previous history of meningeal or peritoneal effusion, ending in cheesy deposits; or signs of degeneration of inflammatory deposits in the knee or other joints, or of rickets. In other cases there are indications of caries of the sternum, ribs, or vertebræ, lumbar or psoas abscesses, or otorrhœa. The patient may have had cough previously. At the beginning of the attack, he complains of high burning fever, and sharp pain on one side of the chest. The fever alternates with chills or rigors and more or less profuse sweats. Auscultation detects crepitation over the greater portion of the lung, but never so fine as in pure pneumonia. After a time the cough becomes more troublesome, and the expectoration, if examined under the microscope, is found to contain quantities of lung-tissue. The sputum is generally opaque and purulent. As the case progresses physical examination of the chest reveals the presence of excavations in the lung. Such patients progressively lose flesh and often die in a few weeks. Sometimes death is due to pneumothorax. This form is not so rapidly fatal as acute tuberculosis, and the patients may survive for some years.

3. *Pneumonic tubercular phthisis.*—When acute, it presents a combination of the clinical symptoms of acute phthisis and acute tuberculosis. In this affection, the tubercles rapidly spread in the lungs and other parts, and have a tendency to caseate and form cavities. The cavities are the result of breaking down of the tubercular masses and not of the pneumonic products. The disease is progressive and soon invades the unaffected lung. The chronic form lasts for years; the progress, though slow, is steady and continuous, and the process is of an obstinately destructive character. This form often has its origin in bronchitis which has

passed on to pneumonia. The inflammatory exudation products constitute the primary stage; subsequently there is fibrous growth occupying the vicinity of the alveoli and peribronchial walls (smaller). The deposits then undergo retrograde changes, viz. caseation, and cavities are formed. At this stage secondary or accidental infection from the caseous masses gives rise to tubercles which become localised in the lung, the infecting materials being carried by the lymphatics, or by the blood, and the process may gradually spread to the intestine. With regard to symptoms, the patient is subject to winter cough for years, but for some time is free during the summer. After a time, the cough does not abate or cease as usual, but is persistent and attended with purulent sputa. There is rapid loss of flesh and also night sweats. On examination sonorous râles are heard under the clavicles. They are coarser and of a creaking character. As the case progresses, cavities soon form in the lungs, and there are all the symptoms of confirmed consumption.

Fibroid Phthisis.—This form of consumption of the lung often occurs in persons whose occupation exposes the organ to long-continued irritation. Dust of some kind is constantly inhaled by such persons when engaged at their occupations. The disease is generally chronic and often secondary to pleurisy or pleuro-pneumonia or to chronic pneumonia. The main feature of this form is fibrosis, a condition in which the lung-structure is replaced by hard fibrous tissue.

History.—A patient recovers from pleurisy with effusion, but on physical examination, dulness is found to remain, and the respiration on the affected side is feeble. The patient now begins to suffer from a short, dry, hacking cough, accompanied with dyspnœa, the respirations being 50 or 60 per minute. The temperature is generally normal, seldom above 100°. After a few weeks, during which time these symptoms increase, the physical examination reveals (1) immobility of the diseased side; (2) a dulness on percussion; (3) considerable shrinking; (4) on auscultation, respiratory murmur absent, its place taken by bronchial breathing, sometimes cavernous respiration. On examining the healthy lung, it is found to have been drawn across to fill up the void. Other organs, as the heart, stomach, and liver, are often displaced.

In unfavorable cases the temperature rises; the cough is more troublesome and drier; the expectoration, though scanty, is often fœtid; dyspnœa is more marked. Other signs of defective aeration and obstructed circulation appear. The urine becomes albuminous, and swellings appear about the feet and ankles. Death is due to dyspnœa or to blood-poisoning.

Post-mortem examination in such cases reveals (1) a lung very much contracted; (2) pleura very much thickened and adherent; (3) the bronchi widely dilated; (4) interlobular connective tissue thickened; (5) the lung structure replaced by hard fibrous tissue; (6) the lung presenting cavities of various sizes, with here and there cretaceous masses; (7) the unaffected lung in a state of tuberculosis; (8) the bronchial glands enlarged, hardened, and pigmented; (9) liver, spleen, and kidneys in a condition of amyloid degeneration.

Causes of phthisis.—These may be conveniently classified as the predisposing and exciting.

Predisposing causes.—Of all predisposing causes that which occupies a most prominent place is *heredity*. A tendency to pulmonary phthisis is in a large majority of cases undoubtedly hereditary. Its development probably depends more upon the nature of the nutritive changes, or the vitiated state of the constitution after birth, than upon any radical abnormality during the growth of the fœtus. There is, however, no doubt that weakness of constitution, which in the parents has already been the cause of phthisis, or which may have developed in them without any lung disease, is transmitted to the offspring. Again, a majority of cases occurs in persons whose parents have been subjects of phthisis in the lung, although symptoms of the disease may not have shown themselves in early life, In such persons there is a history of *ill-health* which subsequently becomes developed into phthisis. Similarly children of *syphilitic* parents or of those suffering from other *exhausting diseases*, are often known to have inherited a disposition to this disease. A similar disposition is supposed to have been inherited by children whose parents were *aged* and *decrepit* at the time of conception. Favorable conditions of hygiene and proper sanitation sometimes neutralise the hereditary disposition in children born of parents who are phthisical or debilitated by disease or old age.

A tendency or disposition to phthisis is often acquired. In such persons, various circumstances or noxious influences lead to the deterioration of general health and ultimately to phthisis. Undue exposure to any of the exciting causes has a very great influence in intensifying the disease. Experience has shown that persons with a very low standard of health have less power to resist any injurious influences, and that they fall ill more readily, and recover more slowly. In such persons the tissues generally are weak and the lungs participate. They are the principal seat of disease. Changes take place in their parenchyma and epithelium, leading to retrograde products, which infect the whole system, through the lymphatics and vessels. In them any irritation or injury to the air-passages or bronchi causes large epithelial proliferation and leads to inflammation of the smaller bronchi or of the alveoli. The various inflammatory processes have been already described. In scrofula, where the tissues are inherently weak, phthisis of the lung most commonly occurs. Similarly in scrofulous persons, who have previously suffered from any inflammatory disease of the air-passages, any slight cause, as exposure to chills, or any irritant inhaled, or even the existence of any poison in the blood, as in fever, measles, diabetes, &c., frequently leads to bronchial catarrh, which readily extends to the alveoli, and often runs on to phthisis. Very often the catarrh remains, the bronchial secretion blocks up the alveoli, and by subsequent irritation and pressure upon the pulmonary vessels leads to destruction of the air-vesicles. Caseous degeneration and phthisis are the subsequent stages.

Various conditions exist in life which materially aid in producing an unhealthy state of the general health. Thus various *injurious influences* produce phthisis during early infancy in children who may not have inherited the disease. During the first year of a child's life, a period of rapid development and growth, any unfavorable hygienic conditions or other external circumstances may lay the foundation of a deteriorated constitution, and thus hinder the normal development of the body. Such persons often have peculiar or characteristic features. Their skin is delicate, there is very little subcutaneous fat, the muscles are flabby, and the bones thin and soft. The disease occurs oftener before middle life than after it. It is mostly observed between the ages of fifteen and fifty-five years. Statistics have shown that phthisis is more common in females than in males.

Injurious customs.—The very common practice among the Parsees of consummating marriages among near relatives, by intensifying inherited morbid tendencies and by preventing their eradication by healthy crosses, undoubtedly perpetuates inherent weakness of tissues generally, and ultimately leads to phthisis. The pernicious custom among the Hindus of marrying at a very immature age, has, I am sure, a very powerful influence for this evil on the constitution. Another injurious practice, common among the people of Bombay, which tends to lower the stamina and develop any latent tendency to phthisis, is too early and too frequent sexual intercourse. In mothers this condition is coupled with repeated and rapid childbearing, often commencing at the very early age of eleven or twelve years.

The practice of not weaning children till the very advanced age of four or five years, as is often observed among the Mohammedans and other natives of Bombay, is fraught with danger to the constitution both of the mother and the child. In phthisical families, and especially when not protected by proper diet and regimen, the effects of prolonged suckling are markedly injurious. In such cases the mother is deprived of fat-elements necessary for the healthy nutrition of the body.

Debilitating influences.—Among these may be mentioned nervous depression as caused by grief, anxiety, disappointments, and losses; vital depression as due to vicissitudes of life, extreme poverty; exhausting passions, as venery, masturbation, excessive drinking, and dissipation; all these tend to produce malaise, and thus weaken the state of general health. The sudden stoppage of an habitual discharge, as of a fistula in ano, is sometimes followed by phthisis; but, on the other hand, the cure of fistula in phthisical subjects is often followed by improvement of the chest symptoms. The rapid increase of population in Bombay, as shown by the census, has had a very great influence in increasing the rate of mortality from phthisis.

Special circumstances.—Neglect of hygiene.—My experience of private practice among large bodies of working classes, and chiefly the factory men, shows me that the chief causes which produce phthisis in them are want of proper exercise in the open air, deprivation of sunlight, and huddling up of a large number of people in small, close, and ill-ventilated rooms, each accommodating, on an average, ten or twelve adults. Secondly, insufficient clothing. In Bombay, the lower class of Hindus generally go about insufficiently clad. A majority of them have no other clothing than a mere waistband. They thus constantly expose their naked skin to the draughts of cold air, and suffer from chills and catarrh of the lung, which are the preliminary stages of phthisis. Such persons after having acquired phthisis die in much greater proportion than any other race. Undue exposure of the skin, especially during the rains, to the moisture and draughts of cold air is a predisposing cause. Persons who allow their clothes to remain on their skin in a wet state suffer more readily than others.

Bad ventilation.—The factory men have to make their way to the mill or factory early in the morning during the cold winter months. They have to work with some hundred others, generally in a room whose atmosphere is laden with solid impurities, as fibres of cotton, wool, or flax. Insufficient and improper food, working from sunrise to sunset, with only a half-hour's rest for meals, and a cramped, and in many cases a stooping posture, not giving sufficient play to the upper portion of the lungs, are also predisposing causes. Similarly, are found of various sizes and in varying stages. In some cases where the liquefaction of masses which surround the bronchi occurs, the accumulated secretion in the terminal bronchi leads to destruction and ulceration of the walls of these tubes, and cavities are formed. The cavities are very often irregular in shape and may be seen to be surrounded by bands of condensed tissue, containing vessels of large size.

It has been invariably observed that in cases of phthisis, where cavities exist about the middle or the lower portion of the lung, their contents are expectorated with difficulty, and therefore readily undergo putrefaction. In cases where the cavities exist at the apex, putrefaction is rare, inasmuch as the contents are readily expectorated. In continually secreting cavities, the contents are generally cheesy matter or fœtid pus. Such lesions present a ragged interior, are surrounded by indurated tissue, and are irregular in shape. Several bronchi often open into them obliquely. The quiescent cavities are lined by a smooth membrane and secrete creamy pus. The cavities open in different directions; some of them into the bronchi; others into the pleura; when they open into any dilated blood-vessel they lead to hæmoptysis. In chronic cases the cavities are quiescent, and lined by thick and tough walls; such cavities are cut off from the surrounding healthy lung, and leave cicatrices behind. A bronchus with which a cavity communicates, very often becomes narrowed and occluded by some tissue-growth and the cavity is therefore practically closed. All these changes lead to diminution in the size of the lung. The healthy tissue in the neighbourhood is compensatorily expanded. There is often displacement of the healthy lung and heart.

Affections of the pleura.—In the early stage of phthisis we often find pleurisy at the apex of the lung associated with the recurrent pleuritic pains. This is due partly to the diseased apex irritating the neighbouring pleura, partly to the extension of inflammation from the lung to the pleura, and partly to the disposition of the tubercle or the infective material to attack the serous membrane. In acute phthisis where the progress is rapid, the pleuræ are not adherent. In chronic cases the diseased lung is more contracted, the formation of tubercles is slow and superficial, and the pleura more tough and indurated in texture, and a firm adhesion occurs. The pleura is thick in fibroid phthisis.

Bronchiectasis.—This morbid condition is often confounded with vomicæ. It occurs in cases where phthisis begins with recurrent bronchial catarrh. The secretion in the terminal bronchial tubes, by its irritant effects, leads to destruction and ulceration of the walls of the tubes, which become dilated. Similar dilatation also occurs muscles of the chest and a diminution in the capacity of air in the upper part.

Local infection.—In scrofulous children, enlargement and caseation of the cervical glands, diseases of the joints, and formation of psoas and lumbar abscesses are well known to be due to the presence of some local infection. In such cases there is a tendency to chronic inflammatory diseases of the lung, leading to caseation or other retrograde degenerative changes.

Contagiousness.—Very little is known about the contagiousness of this disease. The existence of contagion, as is evidenced in small-pox and scarlet fever, is negatived by the fact that the attendants on the sick in various hospitals for consumption seldom suffer. It is probable that an infective influence may arise from the sputa of advanced cases of phthisis, but the infection can readily be counteracted by proper ventilation and the use of antiseptics. Since the recent discovery by Dr. Koch of the bacillus of tubercle, the question of the contagious character of pulmonary consumption has been the subject of much discussion. The following propositions have been advanced:

1. Tubercle is an infective disease, originating in a specific virus, and propagated by the conveyance of that virus from body to body, and in that way alone. 2. The specific virus of tubercle consists of a particular micro-organism found only in tubercle. This organism can be seen in the cells of tubercle, can be obtained in a separate form, and cultivated in successive generations, without losing its original properties. 3. Certain forms of disease termed "scrofulous" are essentially tuberculous, and their characteristic anatomical morbid products contain the infective organism peculiar to tubercle. 4. The disease known as pulmonary consumption is, in the main, a tuberculous disease, and is dependent upon the presence and propagation in the body of the infective organism characteristic of tubercle. 5. Pulmonary consumption is a contagious malady.

With regard to these propositions, it is well known that the idea of the contagiousness of consumption has been often entertained, and its truth often disputed. It must be admitted that consumption is by no means contagious, in the sense that is ordinarily attached to the word. Cases, however, often occur in which the disease appears to have been communicated from husband to wife, and *vice versâ*, and the possibility of this mode of transmission has an important bearing on the question of treatment. If consumption be due to the presence of a micro-organism, the probability of its contagious character is certainly very great.

Post-mortem appearances.—On inspecting the body of a patient are found of various sizes and in varying stages. In some cases where the liquefaction of masses which surround the bronchi occurs, the accumulated secretion in the terminal bronchi leads to destruction and ulceration of the walls of these tubes, and cavities are formed. The cavities are very often irregular in shape and may be seen to be surrounded by bands of condensed tissue, containing vessels of large size.

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Pneumothorax.—This is rare, and is sometimes only a temporary condition. The aperture is soon closed, and the air within the pleural cavity becomes absorbed. It occurs from the breaking down of the pulmonary tissue, and the formation of cavities situated on the surface of the lung. The pleural cavity may contain air and fluid effusion, and communicate with a bronchus. The gas may be a product of simple exhalation from the pleura or of decomposition of a fluid communicating with the external air. The rupture may be due to the breaking down of the texture of the pleura. In the phthisical cavities this change is very rapid; it does not give time for the adhesion of the pleura with the lung substance. The pleura therefore becomes soft and very readily yields to very slight pressure of air, as during coughing. Rupture may occur at any period of phthisis; even a small tubercle close to the pleura may itself soften down and lead to perforation. In advanced cases a phthisical cavity is a most common cause, and rupture is most common on the left side. In acute cases rupture also occurs.—In miliary tuberculosis, the bronchial, cervical, and mesenteric glands become enlarged and undergo various degenerative changes, viz. caseation and calcification. The peritoneum, the arachnoid, and even the pericardium become affected with tubercles in many cases of acute tuberculosis.

With regard to lesions of other organs in cases of phthisis, the most important perhaps is ulceration of the bowels. This is a most common complication of phthisis.

In it there is at first catarrhal inflammation, leading to swelling of the gland-follicles of the small and large intestines. There is proliferation of the cells in the submucous tissue, followed after a time by caseous degeneration ending in destruction and discharge of the degenerated products, leaving ulcers behind. Some have supposed that the tubercles or the infection begin in the lymphatic tissue and thence spread. The granulations are often connected with the lymphatic vessels, and may originate in their sheaths. The ulcers, in whichever way they have formed, are generally transverse; they are irregular in form and present undermined and indented margins. In a few cases they even extend to the serous membrane beyond. Once formed they tend to spread to the lower portion of the bowel, and hence very often they are found in the rectum. The mucous membrane surrounding the ulcers is in a state of congestion, varying in amount at different times and in different cases. Hence diarrhœa is present in some cases and may be absent in others. Perforation of the bowels has been noticed in a few cases. With regard to the seat of the ulcers, the ileum, the cæcum, and a portion of the colon are the portions of the bowels most often involved in this change.

Laryngeal ulceration.—This is most common, and often arises as a complication of phthisis in advanced cases. In adults the tubercles sometimes appear first in the larynx and trachea, and undergo various changes, ultimately leading to minute ulcers, the margins and floor of which are also the seat of fresh tubercles. Some pathologists consider that laryngeal ulceration is due to a sort of catarrh of the mucous membrane of the larynx, as occurs chiefly in scrofulous persons. They contend that in such cases the disease extends rapidly to the submucous glands, the inflammatory processes undergo various changes leading to ulcers with tubercles surrounding them. Tubercular ulcers of the larynx have been already fully described (see page 240).

Symptoms.—Phthisis may begin in several ways. It may set in (1) after bronchitis; (2) after lung disease of any kind; (3) after an attack of hæmoptysis; (4) with general debility, often accompanied in women with amenorrhœa; or (5) after acute diseases as smallpox, measles, whooping-cough, and fever.

Some disorder of the general health is always present before there is any evidence of the disease in the lung. *Pyrexia* is one of the most constant symptoms in all cases of phthisis, and is especially marked in the acute form. Other symptoms refer to morbid processes in the respiratory organs, and to defective nutrition and assimilation, as evinced by poverty of blood and emaciation.

Broadly considered, the symptoms of phthisis vary according as the disease is due to pneumonic processes, as in pure pneumonic cases; to primary deposit of tubercles, as in pure tubercular phthisis; or to pneumonic processes, with tubercles developed at an advanced period, as in pneumonic-tubercular phthisis.

Symptoms due to morbid processes in the respiratory organs.—This category includes those due to (1) bronchial or alveolar catarrh; (2) various morbid pneumonic processes, which ultimately end in destruction of the lung tissue; (3) primary tuberculosis in the lung; (4) destructive inflammatory processes, with secondary deposit of tubercles; (5) complications which supervene during the course of the disease, as tuberculosis of other organs, *e.g.* the pleura, intestine, or larynx.

(*a*) *After bronchitis.*—In some children, phthisis immediately follows upon whooping-cough or measles. In persons who are cachectic, or are the subjects of a scrofulous diathesis, and in girls suffering from amenorrhœa, phthisis often sets in an insidious manner, and after more or less frequently repeated attacks of bronchial catarrh. The catarrh after existing for many years often spreads deeply into the alveoli, and leads to catarrhal pneumonia. The disease then merges into pneumonic processes, which ultimately end in consolidation and disintegration of the lung. In some cases the bronchial catarrh remains protracted for several weeks, during which time the fever increases, the cough and expectoration continue, and there is loss of flesh. In such cases it is probable either that the catarrh has infiltrated the peribronchial tissue and extended to the alveolar walls, or that the pneumonic processes are present. Where the bronchial catarrh exists for months or years, as occurs in persons suffering from winter cough, there is no fever and no loss of flesh, though the patient has for some time had cough and expectoration. In such cases, if phthisis occurs, the catarrh then spreads into the alveoli, and there is fever with rapid loss of flesh. The bronchial catarrh generally begins in the small bronchi. In a few cases it begins in the larynx or the trachea, and thence extends into the bronchi and spreads into the alveoli. In such patients phthisis commences with hoarseness of voice before any other symptom of catarrh, although the physical signs are those of bronchitis only. Cases of bronchitis commencing at the apex almost invariably end in phthisis, whereas cases of bronchitis ending in pneumonia, and confined to the lower portion of the lung, generally get well.

(*b*) Phthisis often occurs after catarrhal pneumonia; such patients are generally cachectic. After the pneumonia has subsided they suffer from a short dry cough for a shorter or longer time, and lose flesh and strength. This is the most common way in which phthisis sets in, and the result is known as pure pneumonic phthisis. During the first stage of phthisis the inflammatory process is due to some direct injury to the inner surface of the air-vesicles, and the consolidation consists of intra-alveolar accumulation. The exudation is fibrinous, and there are few leucocytes. In such cases, absorption follows if the health is good.

Where the leucocytes and the exudation products largely predominate, absorption is slow, pneumonia becomes chronic, the with the lymphatic vessels, and may originate in their sheaths. The ulcers, in whichever way they have formed, are generally transverse; they are irregular in form and present undermined and indented margins. In a few cases they even extend to the serous membrane beyond. Once formed they tend to spread to the lower portion of the bowel, and hence very often they are found in the rectum. The mucous membrane surrounding the ulcers is in a state of congestion, varying in amount at different times and in different cases. Hence diarrhœa is present in some cases and may be absent in others. Perforation of the bowels has been noticed in a few cases. With regard to the seat of the ulcers, the ileum, the cæcum, and a portion of the colon are the portions of the bowels most often involved in this change.

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Broadly considered, the symptoms of phthisis vary according as the disease is due to pneumonic processes, as in pure pneumonic cases; to primary deposit of tubercles, as in pure tubercular phthisis; or to pneumonic processes, with tubercles developed at an advanced period, as in pneumonic-tubercular phthisis.

Symptoms due to morbid processes in the respiratory organs.—This category includes those due to (1) bronchial or alveolar catarrh; (2) various morbid pneumonic processes, which ultimately end in and tone from the first in cases of phthisis, where the primary deposition of tubercle is in the larynx or the trachea, and at a later period spreads into the smaller bronchi. In pneumonic cases complicated with tubercles the hoarseness of voice occurs at an advanced period, and is an important sign of the existence of tubercles in the larynx. In these cases the hoarseness of voice is due to the tissues of the larynx and of the throat being inflamed and degenerated. Persistent huskiness of voice or actual aphonia is a sure sign that phthisis exists in the larynx. The huskiness may clear off, but the voice remains somewhat altered in quality. Very often it is reduced to a peculiar whisper, audible only when a great effort is made in speaking; when once established it is an incurable disease. In a few cases the hoarseness is obviously due to paralysis of the vocal cords, caused by pressure of the thickened pleura, or of the enlarged bronchial glands on the recurrent laryngeal nerve.

(7) *Hæmoptysis.*—It is not met with in every case of phthisis. Early hæmorrhage, either bronchial or from the already inflamed lung, and slight in amount, is very common. It may be in some cases a cause of the commencement of phthisis in the lung. It is often followed by marked symptoms of pyrexia, cough, &c., and especially by loss of weight. The first outburst is rarely fatal. Its quantity varies from mere streaks in the sputa to many ounces expectorated in a few minutes. Profuse hæmorrhage, when early, generally occurs in acute cases, and is then due to extensive congestion of the lung, and to a weak and degenerated state of the pulmonary vessels. In phthisis beginning after profuse hæmoptysis the progress is very rapid, and softening of the lung takes place very early. In advanced cases, when the hæmorrhage is profuse, it is chiefly due to the erosion or bursting of a branch of the pulmonary artery in the wall of an old cavity. The blood is dark, and not frothy. Slight hæmorrhage often occurs, and, when frequently repeated, shows that phthisis has fairly set in. The hæmorrhage may be bronchial, or from the pulmonary artery. In either case a portion of it enters the air-cells and coagulates, and may give rise to irritative broncho-pneumonia and to subsequent destruction of the lung. Hæmoptysis may be brought on by violent cough, or may occur without such causation at irregular periods.

(8) *Disordered menstruation.*—During the menstrual period there is increased fluxion of blood towards the uterus; this serves in a measure to remove the excess of supply from the lungs caused by the inflammatory processes in phthisis. During pregnancy a similar condition exists; hence during these epochs the symptoms of phthisis are less severe than at any other period. Amenorrhœa is a common symptom in young women suffering from phthisis.

alveoli become thick, caseation of the epithelium follows, with symptoms of phthisis; pneumonic phthisis generally begins with this kind of catarrhal pneumonia. In this variety the fever, though slight at first, is persistent, the cough is attended with muco-purulent or slightly bloody expectoration, showing that there is catarrh of the alveoli, but the physical signs are not well marked. The respirations may be weaker at one apex or imperfect. A few moist râles may be heard at the moment of cough, and not with the first inspiration following a cough.

(c) *After an attack of hæmoptysis.*—Hæmorrhagic phthisis, so called, has no distinct hæmorrhagic origin. It does not arise from the results of hæmoptysis. The term is applied to cases in which large and repeated hæmorrhage occurs or is a marked symptom. Bronchial hæmoptysis occurs primarily at some period or other. Such hæmorrhage sometimes occurs in strong persons, who never become phthisical. In persons predisposed to consumption hæmoptysis is often the first indication of the pulmonary lesion. It often precedes cough and expectoration, and it may occur before any reliable signs of phthisis can be discovered. Bronchial hæmorrhage may appear at any time during the course of phthisis, and is most common when cavities exist in the lung. In a majority of cases there are signs of failing health before the hæmoptysis; sometimes the patient is in good health, and is suddenly attacked with profuse hæmorrhage, which sometimes lasts for many days, causing loss of strength and emaciation. Hæmoptysis is generally followed by irritation of the lung or catarrhal pneumonia. On the second or third day after the hæmorrhage the patient suffers from pyrexia. The temperature rises, and there is frequent pulse. The pleura is also very often irritated, and there may be pleuritic pains in the lateral parts of the chest. There is cough, attended with bloody expectoration, or mucus tinged with blood. The physical signs are those of catarrhal pneumonia, and they are most marked at the base. This peculiarity can be explained as the natural effect of gravitation, aided by the expansile movements of the lung, tending to remove the blood from the apex. There is slight dulness, with feeble vesicular breathing and moist râles, indicative of inflammatory changes in the lung.

(d) *Symptoms preceded by general debility or low state of health of the individual.*—In these cases there may be some history of predisposition, associated with improper habits of life, various sources of nervous or vital depression, or malaise. In such patients the functions of nutrition and assimilation are defectively performed. The susceptibility of the tissues to any injury is very great, and there is less than the normal power to recover from the effects of inflammation. The lungs are weak. Such patients generally have characteristic features; they are depressed in health, and their digestion is often faulty, and there is considerable irritation of the intestines. The tongue is white and the urine scanty. The pancreas does not secrete as in health, and hence the emulsification of fats in the intestines is not properly performed. Such patients generally have an aversion for fatty food. Such a state is soon followed by occasional pain in the upper part of the chest, and chiefly in the affected side, by cough, which persists for a longer or shorter time, and other symptoms referable to some mischief in the respiratory organs. The cough may be slight or severe, may be dry and troublesome at night or early morning; it may be followed by the expectoration of clear, sticky, mucous sputa of bronchitis, or yellow, stringy expectoration, or the sputa streaked with blood of catarrhal pneumonia. During this time the patient, without any apparent cause, becomes thin and emaciated, and complains of loss of hair, of extreme weakness, and inability for exertion. He also suffers from shortness of breath, occasional giddiness in the head, slight attacks of fever, and night sweats; the pulse is somewhat frequent. All these are unmistakable evidences of the development of phthisis. The progress is generally slow, and the disease may remain localised at the apex for a long time. The cough at first is very often bronchial, and subsequently it extends to the alveoli, ultimately leaving cheesy products behind.

As a rule, the symptoms are not in proportion to the progress of the disease. Favorable cases are those where the catarrh is limited to the apex, and it is generally bronchial. Such cases often improve, and the fever disappears in a few days. In protracted cases, the catarrh infiltrates the peribronchial tissues, and also invades the alveolar walls. The cough is more persistent; the fever does not subside; it remains protracted, and even increases at the end of the first or at the beginning of the second week. The pyrexia now exacerbates towards evening, and is followed by profuse sweats on leaving the bed in the morning. The emaciation is also extreme. In such cases the existence of tubercles in the lung may be suspected, if the patient, who up till now had been slightly or not at all short of breath, suffers at once from increased frequency of respiration. In acute cases, or in cases known as galloping phthisis, the progress is very rapid, and the fever is very high and continuous. There is rapid loss of flesh; the health is much depraved. The sputum is peculiar; it is chiefly globular or nummulated in form and profuse, especially in the morning; it often contains ricelike bodies, indicative of destruction of the smaller bronchial walls or of the alveoli. The matters expectorated, being chiefly the products of the smaller bronchi, do not sink in water. In acute tubercular cases the cough is generally tedious and troublesome, and the sputum is scanty, consisting chiefly of insipid and transparent fluid. In such cases the patients generally die within a few weeks. In favorable cases the progress of all these stages is arrested; the caseous degenerated products either become encapsulated and inspissated, or they liquefy and are expectorated; fibroid connective tissue fills up the place of the degenerated alveoli, causing great induration.

Physical signs.—These depend on the amount of the inflammatory products massed together, or the extent of the consolidation; upon the number of tubercles, and on the irritation the consolidation or tubercles have set up in the lung. The lung is indurated at the apex. There is slight impairment of movement of the chest at the affected part, which is also flattened. There is more or less dulness over an area extending from the clavicle to the third rib. The respiratory murmur is impaired or very feeble, or is more bronchial. There is crepitation heard both during inspiration and expiration; and there is also increased vocal resonance and bronchophony. The heart-sounds are heard more distinctly over the affected area. Occasionally dry friction-sound is heard under the clavicle and in the supra-scapular region.

All these symptoms and signs show that phthisis is fairly established. If the case progresses the cheesy degeneration leads to destruction of the lung substance and to formation of cavities. In such cases the symptoms are those of softening of tubercular masses and of cavities in the lung. The cough, owing to the defective expansion of the lung, is very violent and troublesome; such persons lose flesh very rapidly. There is high pyrexia, the temperature rising at night, and copious night sweats. These symptoms are not invariably present; the temperature is often normal or even still lower, the expectoration diminishes, the patient begins to gain flesh, the fever disappears, and the nutrition improves. This condition may continue for some time, but there is always the danger of fresh pneumonic attacks or of fresh formation of tubercle. When these processes take place there is disintegration of the adjacent lung tissue, or tubercles are deposited round the walls or in the neighbourhood of cavities as secondary growths, and set up fresh irritation. The symptoms again become troublesome, and consist especially of violent cough, with expectoration of a yellow colour, streaked with blood.

In this stage, the respiratory movements at the upper part of the chest are defective, and there is flattening of the chest wall at the affected part. There is increased dulness owing to infiltration of the neighbouring lobules or there may be increased resonance (amphoric) due to air in the cavity taking the place of the expectorated fluid. Bronchial respiration, or the amphoric respiratory sounds are heard, and these may be accompanied by resonant or metallic râles. No respiratory sounds are heard when the cavities are filled with secretion.

There are other signs which mark the confirmed consumptive. These are—hectic flush on each cheek, clubbed nails, and a pearly hue of the sclerotic. In cases where there are large cavities the expectoration is nummular, abundant, and often contains portions of lung tissue and traces of the remains of bronchi. The cavities may open into the pleura and cause pneumothorax or pyopneumothorax. Where the tubercles are superficial, and in the early stage of tuberculosis, the adhesive pleuritis prevents the opening of the cavities into the pleural sac.

In addition to continuing open or spreading, the cavities may contract, and the sides, approaching each other, form a firm cicatrix. Where this process takes place the neighbouring tissues or organs are liable to become displaced. The cicatrisation of the cavities has a favorable import as regards prognosis. The patient begins to improve. A similar favorable condition is often met with in cases where the cavity remains quiescent and no fresh deposition of tubercles takes place. Such patients, under favorable circumstances, often live for years, subject, however, to the distressing expectoration and annoying dyspnœa. Where the cavities continually increase by ulcerative processes, tuberculosis rapidly extends to the opposite lung; all the symptoms of cough, dyspnœa, expectoration, and fever increase. The emaciation becomes extreme and the patient soon looks like a skeleton. The blood is poor in quantity, even in proportion to the diminished respiratory surface. It is also deteriorated in quality. It is thus that thrombosis in the veins of the lower limbs and œdema of the feet and ankles so commonly occur in advanced stages. Bedsores in the most dependent parts and in those exposed to pressure, and hypostatic congestions are common. Aphthæ are common, and when they appear on the tongue or fauces they are often foretellers of the near approach of death.

In cases where the cavities undergo cicatrization, and where fresh deposit of tubercle does not take place, beyond the inconvenience of regular expectoration and occasional dyspnœa, the patient may be but little inconvenienced. The physical signs are flattening of the chest wall chiefly under the clavicles; the absence of moist râles and cavernous sounds, and substitution of harsh breathing. If the cavity be in the left lung, the right lung is drawn to the affected side, the heart and stomach are somewhat displaced. In the case of a cavity in the right lung, the liver is pushed upwards and the heart displaced to the right of the median line.

Further course and progress.—Phthisis, when once established, frequently ends in death. The tubercular variety is always fatal. In the pneumonic cases improvement almost always occurs. Persons once affected are in greater danger or more liable to attacks of the pneumonic or tubercular phthisis than other persons.

Symptoms of Consumption in Detail.—In whichever way the disease commences the symptoms are generally obvious. In the early pneumonic stage they refer to inflammation of some portion of the lung and its consequences. In pure tubercular cases there is the high fever which follows the irritant action of the tubercles upon the tissues of the lung. They also refer to defective assimilation, while occasionally the symptoms are very insidious. In advanced cases other symptoms are often superadded, *e. g.* those due to tubercles in other organs, as the larynx or intestines, and to fatty and lardaceous degeneration of the kidney and liver.

Symptoms due to inflammation of some structure of the lung.—These are (1) pain in the chest and shoulders. It is often present in phthisical cases, and varies from a dull aching feel to a pleuritic pain. It may be confined to the apex, or may be felt below the clavicles, or between the shoulder-blades. It is sometimes absent altogether. When it exists it increases with cough and on deep inspirations. It often recurs at successive periods; quick walking or other exercise sometimes increases the pain. It inflicts much discomfort upon the patient, and causes him to become more or less low-spirited. In acute cases there is always pain. In advanced cases the pain is chiefly muscular or may be due to cough.

(2) *Hurried respiration.*—The frequency of respiration is often in an inverse ratio to its depth. It varies with the amount of lung surface involved. The frequency is generally increased in all forms of pulmonary phthisis, although in some an opposite condition is observed to exist. The increase is greater in some varieties than in others.

(3) *Dyspnœa.*—The painful sensation of want of air being not satisfied, otherwise known as dyspnœa, is not always present. In advanced cases there is dyspnœa only at times, and when it exists it is one of the most troublesome symptoms. Such patients are very much emaciated, there is increased tissue change, the aerating surfaces in the lung are considerably diminished, and an additional or extra supply of air is obtainable only with painful exertion. Fresh attacks of catarrh very often supervene in such cases, and the bronchial tubes are still further narrowed, and hence the respirations are also abnormally frequent. In phthisis there is pain on respiration, and also fever, both of which conditions lead to hurried respiration. Where all the causes are combined, the patient invariably suffers

from hurried respirations and dyspnœa. In persons with extensive cavities, when lying at rest the respirations are often only slightly above the normal rate. This can be accounted for by the fact that the remaining healthy portion of the lung, by an increased interchange of air, compensates for the loss of the aerating surface. In acute cases, as acute phthisis, or acute tuberculosis, the respirations are frequent. Fever is the most important cause of increased frequency of respiration, but not always so. In fever there is morbid increase of heat in the body, as occurs after bodily exercise, more carbonic acid is formed, and more oxygen is required. The want is very often satisfied by the great depth of each inspiration, and hence with fever the respirations are not always frequent. In pure tubercular cases a great number of the alveoli and also the smaller bronchi are filled with exudation products and granules, and they therefore become narrowed. In these cases high fever follows the irritant action of the tubercles upon the tissues of the lung ; hence, even in the early stage of phthisis, the sudden increase in the frequency of respiration, without any physical sign of consolidation is a sure sign that tubercles exist. Again, in pneumonic cases, with symptoms and signs of extensive disintegration of the lung and formation of cavities, if on a sudden, frequency of respiration associated with dyspnœa is observed, even without any increase of fever, we can safely conclude that secondary tubercles have complicated the existing phthisis.

(4) *Cough.*—In a majority of cases it is a cause of great distress. With some at the commencement it is scarcely a matter of complaint; it is very often so slight that patients cannot remember when it commenced. It often precedes for a long time phthisical processes, and is then due to bronchitis. The bronchial catarrh is protracted, it subsequently extends to the alveoli, and by cheesy degeneration leads to phthisis. In pure pneumonic cases there is at first cough and expectoration, and these are followed, after a time, by high fever, loss of weight, and pallor of the skin. In the fibroid form of phthisis the cough is frequently paroxysmal and exhausting. In pure tubercular cases there is pyrexia and loss of flesh, either before or associated with cough, and frequent respiration and expectoration follow after a time. Generally, however, it is dry and hacking at first; it is worse after meals, and also on going to bed and in the early morning, and is often followed by vomiting of food. It is much influenced by the humidity and temperature of the atmosphere; hence it is increased during the cold season. It is comparatively less troublesome in summer.

(5) *Expectoration.*—It is very often associated with cough. In cases due to bronchial catarrh the expectoration is at first clear,

viscid, tenacious mucus, which is also frothy. When the catarrh spreads into the smaller bronchial and alveolar walls the cough is generally persistent, and the expectoration consists of deep yellow, stringy sputum, rich in cells. When the expectoration is slimy or muco-purulent, or tinged with blood, it indicates the beginning of the pneumonic processes of cheesy metamorphosis. In acute tuberculosis the expectoration may be only viscous and frothy. During the course of the disease cough may continue for several weeks without any expectoration, or both cough and expectoration may be absent. During pneumonic consolidation, or the consolidations associated with tubercular nodules, the expectoration may be scanty or disappear altogether, and yet the cough may be very troublesome and protracted. Such cases are very suspicious. In them, besides the pneumonic processes, the tubercles have infected the bronchi and the alveoli. In cases where cavities exist with the softening or breaking down of the pulmonary tissue, the expectoration is most abundant in the morning; it is muco-purulent, and contains elastic fibres. Where the cavities are large, the expectoration is profuse, and consists of opaque, greenish-yellow masses, which are neither frothy nor tenacious. They sink in water, and are nummulated or moulded during their escape through the air-passages, and they are very often fœtid. Such expectoration is frequently mixed with more or less bronchial mucus. Blood is sometimes found, either in a thin layer on the surface of the expectoration, or mixed up in its substance; the colour varies from light red to reddish brown. Sometimes the expectoration from cavities is pure pus, and is easily coughed up. In cases of cavities due to caseous abscesses the expectoration occurs very suddenly, and contains an immense quantity of pus. In such cases the softening of the caseous product takes place uniformly, and in the centre; it gradually spreads throughout, and at last the pus escapes through a bronchus. In some advanced cases, where diarrhœa is very abundant, cough and expectoration undergo marked diminution or disappear altogether. The characteristic sputa of cavities often become intermittent. This symptom is due to a cavity obliquely communicating with a bronchus, so that the secretion remains pent up for a time. The expectoration of cavities, when examined under the microscope, reveals caseous masses, epithelium from the air-cells, abundant granules, and pus-cells, also blood-corpuscles, fat and oil-globules, and fragments of elastic tissue. The discovery of yellow elastic tissue in the sputa is a clear evidence of the advanced condition of the disease. Various micro-organisms, among them the bacillus of tubercle, can also be detected.

(6) *Hoarse voice.*—The voice is almost always altered in quality

and tone from the first in cases of phthisis, where the primary deposition of tubercle is in the larynx or the trachea, and at a later period spreads into the smaller bronchi. In pneumonic cases complicated with tubercles the hoarseness of voice occurs at an advanced period, and is an important sign of the existence of tubercles in the larynx. In these cases the hoarseness of voice is due to the tissues of the larynx and of the throat being inflamed and degenerated. Persistent huskiness of voice or actual aphonia is a sure sign that phthisis exists in the larynx. The huskiness may clear off, but the voice remains somewhat altered in quality. Very often it is reduced to a peculiar whisper, audible only when a great effort is made in speaking; when once established it is an incurable disease. In a few cases the hoarseness is obviously due to paralysis of the vocal cords, caused by pressure of the thickened pleura, or of the enlarged bronchial glands on the recurrent laryngeal nerve.

(7) *Hæmoptysis.*—It is not met with in every case of phthisis. Early hæmorrhage, either bronchial or from the already inflamed lung, and slight in amount, is very common. It may be in some cases a cause of the commencement of phthisis in the lung. It is often followed by marked symptoms of pyrexia, cough, &c., and especially by loss of weight. The first outburst is rarely fatal. Its quantity varies from mere streaks in the sputa to many ounces expectorated in a few minutes. Profuse hæmorrhage, when early, generally occurs in acute cases, and is then due to extensive congestion of the lung, and to a weak and degenerated state of the pulmonary vessels. In phthisis beginning after profuse hæmoptysis the progress is very rapid, and softening of the lung takes place very early. In advanced cases, when the hæmorrhage is profuse, it is chiefly due to the erosion or bursting of a branch of the pulmonary artery in the wall of an old cavity. The blood is dark, and not frothy. Slight hæmorrhage often occurs, and, when frequently repeated, shows that phthisis has fairly set in. The hæmorrhage may be bronchial, or from the pulmonary artery. In either case a portion of it enters the air-cells and coagulates, and may give rise to irritative broncho-pneumonia and to subsequent destruction of the lung. Hæmoptysis may be brought on by violent cough, or may occur without such causation at irregular periods.

(8) *Disordered menstruation.*—During the menstrual period there is increased fluxion of blood towards the uterus; this serves in a measure to remove the excess of supply from the lungs caused by the inflammatory processes in phthisis. During pregnancy a similar condition exists; hence during these epochs the symptoms of phthisis are less severe than at any other period. Amenorrhœa is a common symptom in young women suffering from phthisis.

(9) *Night sweats.*—These are common in all cases of phthisis. They come on generally towards morning, and while the patient is asleep. When excessive they cause great distress and exhaustion.

(10) *Fever.*—Phthisis is often associated with elevation of temperature and increased frequency of pulse. The fever is probably due to some morbid poison circulating within the system or localized in the lung (tuberculization). It is also due to the inflammatory and destructive processes in the lung. When a low temperature exists it is in proportion to the extent to which the vitality is depressed. Fever is due to increased production of heat the result of excessive waste of tissues. In this process the fat, the muscular tissue, bones, and nerves, and even the red corpuscles of blood undergo a form of wasting or degeneration. Where the fever remains high for some time, the weight generally decreases very rapidly. In cases in which the temperature remains only moderately high the patients seldom lose much weight; whereas in patients with hectic fever, in whom the temperature chart shows exacerbations in the evening after morning remissions, the loss of weight is much more rapid. The fever runs a very irregular course. It may be continuous, it may be slight, may be of an intermittent character, or may be altogether absent. In phthisis the temperature chart varies from 94° to 105°. In acute pneumonic, and in pure tubercular phthisis, the fever is very high; it commences very early and is continuous throughout the disease. Its virulence shows the nature of the destructive process. In phthisis due either to extension of bronchial catarrh to the alveoli, or to pneumonic processes from the first, there is at the commencement fever with frequent pulse. As the case progresses, the fever continues and the temperature chart is almost pathognomonic. The difference between the morning and evening temperature amounts to 1·5° or 2°. In a majority of cases the chart shows that the fever has assumed a hectic form. In these cases there is a morning remission, when the temperature may be 100° or 101°. It is seldom normal; as a rule it does not go below 99°. In the course of some hours or during the day it begins to rise and continues till night, when it reaches to 104° or 105°. A fall then is noticed and at about 4 a.m. the chart may be as low as 95°. During exacerbation there is burning heat in the palms and soles and flushing of the cheeks. In chronic cases, where the cheesy products become fibrous, or may have liquefied after a time and been expectorated, leaving cavities at the apex of the lung, the fever may gradually disappear and the patient improve. In cases, likewise, where the cavities cease to extend or begin to cicatrize the fever intermits or disappears altogether. In quiescent cases the temperature is generally 97° or 98°. Where

cavities extend and fresh tuberculosis takes place the chart resembles that of pyæmia or septic poisoning. It shows great extremes. The evening exacerbations and the fall at night show extreme vital depression.

(11) *Pulse.*—In the early stage of consumption the pulse is frequent, regular, and seldom hard. In advanced and progressive cases the frequency still increases, but the pulse generally becomes soft and feeble. In chronic cases it is weak, frequent, and regular. In phthisis, the blood being deteriorated in quality, is deficient in fibrin and is less scarlet; the circulation is feeble, the extremities are often cold and somewhat livid.

(12) *Chills.*—Morning and afternoon chills are exceedingly common in cachectic persons during the early stage of consumption, and show that some infective poison is beginning to develop in the blood, or that caseous degeneration is going on somewhere in the body. They are also common in advanced cases of phthisis with cavities. They rarely amount to rigors. The patient for about half an hour or an hour feels chilly sensations and is very uncomfortable. These chills pass off without sweating.

(13) *Progressive wasting of the body or emaciation.*—Phthisis is a wasting disease. It is attended with an increase of temperature and metamorphosis of various tissues of the body, both tending to emaciation. Emaciation is more marked about the body and limbs than the face, and especially about the chest. The patient looks anæmic. In these cases the pancreas and other chylopoietic viscera also suffer and their functions are deranged. Fatty articles of food, if taken, are not properly emulsified, and the fat thus enters the small intestine in a defectively prepared condition for assimilation. The fat, therefore, is not properly absorbed. In such cases, the digestion generally is often very weak and the gastric juice is insufficient and abnormal. As a result the supply of properly prepared materials to the blood and tissues is cut off. The blood, which during health can supply sufficient hydrocarbonaceous materials, owing to the absorption of fat, now cannot afford any for the direct consumption of the body. It is also unable to afford any supply to replace that which is required for the nutrition of the albumenoid tissues of the body. On the contrary in phthisical cases the blood takes away more materials from the tissues for direct combustion. Hence the tissues always disintegrate, their power of repair is diminished, and wasting is the result. Emaciation and debility rapidly increase in acute cases. The course is gradual in advanced but progressive cases. In chronic cases the wasting is often slow, and very often there is an interval during which the weight is increased. In every case of phthisis it is desirable that the weight should be taken every week

or fortnight. In advanced cases the skin becomes wrinkled, and it is usually dry and scaly and also thin and œdematous. There may be œdema of the legs, or swelling of an arm, due to thrombosis of the veins. The clubbed form of the fingers and toes is due to the absorption of the pad of fat normally present.

Deranged digestion.—The digestive organs are early affected in phthisis and chiefly in chronic cases. This derangement is due to morbid states of the blood and general malaise. Dyspepsia is common, with signs of sub-acute gastritis. The appetite is often impaired; it is sometimes capricious, and sometimes totally absent. There may be some nausea with occasional vomiting of food. The tongue may be clean throughout or may be furred. When intestinal lesions co-exist the appearance of the tongue is characteristic. At the commencement of the disease it is generally red all over, more or less furred or thickly coated, but often somewhat dry and glazed and fissured. The papillæ are enlarged or very red at the tip and edges. The fur very often clears off in patches, leaving a red, raw-looking and glazed surface exposed. Vomiting of food is very common when the tongue is in this condition. It is excited on the least disturbing causes. The food rapidly decomposes. Pain in the abdomen and round the umbilicus is often complained of during indigestion.

Diarrhœa.—It is the most common complication met with and occurs in about 60 per cent. of cases during the course of the disease. It is most common during the third stage. Anything that deranges the digestion leads to it. Swallowing the expectoration from phthisical cavities conduces very much to its production. Diarrhœa is often due to catarrh of the bowels; the patient passes loose, pale-coloured, semi-feculent stools. When persistent it is a most serious complaint, and may then be due to ulceration of the bowels. In all cases there is more or less pain round the umbilicus. The ingestion of fluid or solid food often causes copious stools in phthisical cases. The looseness is at first amenable to treatment, and under proper care and attention the stools become natural. In such patients relapses very often occur, and then the looseness is worse than before. Pain and tenderness in the right iliac fossa is due to ulceration of the bowels and is very common in phthisical cases. The pain may be confined to this spot, or be felt in other parts. In such cases the stools are frequent but scanty, and contain mucus and blood; very often they amount only to a teaspoonful or slightly more. When ulcers exist in the ileum, the abdomen will be generally sore or some tenderness will be felt round the umbilicus, and there will be diarrhœa associated with dyspepsia, and the diarrhœa will cease and recur. Ulceration affecting the cæcum is also common in phthisis. In such cases the diarrhœa is persistent and the stools contain mucus streaked with blood. There is also rapid emaciation, and the patient looks haggard and worn-out. Where the ulcers are confined to the rectum there are dysenteric symptoms. It has invariably been noticed that in phthisis if the diarrhœa assumes a very virulent type, cough and expectoration become less or disappear, and other chest symptoms also abate considerably. Similarly, uncontrollable bowel complaint has improved on the reappearance of chest symptoms.

Another important fact worthy of note with reference to ulceration of the bowels is, that extensive ulceration has been noticed post-mortem without any history of pain or tenderness having existed during life. In these cases, moreover, the patients complained of constipation. These symptoms may be explained by the fact that in severe ulceration of the bowels, the muscular coat often suffers. Under these circumstances the peristaltic action is interfered with and constipation may occur.

Physical signs.—State of the body.—The body of a phthisical patient presents various abnormalities. Such patients have a slender figure and peculiar features, which are usually well formed. A careful study of the physiognomy and facial characters of patients suffering from phthisis, or of those who are prone to consumption, has shown that there is a certain similarity of features in them all. Such people have a defectively developed body. Their bones are slender, the skin is thin, and there is very little subcutaneous fat. The muscles are ill-developed. The face is peculiar. The cheeks present a hectic glow, the sclerotics are pearly blue. The neck is too long, and its muscles allow the chest to sink. The surface of the chest is characteristic. The thorax is flatter, longer, and narrower than in health. There is often a want of symmetry on the two sides. The ribs are spread widely apart. The shoulders come forwards.

The Physical Signs in the Chest.—These vary with the intensity of the inflammatory processes and with the stage of the disease. They also depend upon the number of tubercles and the amount of irritation they produce in the lung. In the early stage the physical signs are those due to bronchial catarrh, being caused by the swelling of the mucous membrane of the bronchi, and the presence of bronchial secretion. Here and there scattered pneumonic deposits, or peribronchitic deposits, or tubercles may exist.

Inspection.—The depressions of the upper part of the chest, and chiefly in the supraclavicular region, show that the apex of the lung is dragged down by adhesion of the pleura, and diminished in size by induration or consolidation. The appearance of contraction under the clavicles in chronic cases is a favorable sign, and shows that the disease has been arrested for some time. When contraction occurs coincidently with rapid progress of the disease, it shows that the consolidation products are softening down and leading to rapid destruction of lung substance.

Defective respiratory movements in the upper and front part of the chest.—A comparison should be made between calm and deep breathing. Defective movement shows that tubercles or pneu monic consolidation and pleuritic adhesions exist in the affecte part. The movement is also defective when the apex of the lung indurated or shrunken. In such cases the affected lung is imp meable to air; it cannot follow the elevation of the chest by inspiratory muscles.

Palpation. — Vocal fremitus is more marked. This den inflammatory consolidation or the deposit of tubercle. The densed lung tissue is an excellent conductor of the vibrati Muscular irritability is marked in phthisical patients.

Percussion.—In phthisical patients percussion should be with the mouth open, so that the tympanitic sound of the tr can be readily distinguished from the non-tympanitic sound lung. As the disease at first is chiefly confined to the ape examination should be carefully made in front and at the The percussion over the supra- and sub-clavicular regions is wanting in elasticity or less resonant than on the sound side. defect may be due to the consolidation made up of infiltrati ducts or of connective tissue growth.

Auscultation.—At the apex of the affected lung the si those of bronchial catarrh. The breath-sounds are harsh are often accompanied by occasional moist or coarse crepi sometimes the harsh sounds are heard after the first ins which follows a cough. On going downwards in the p regions we hear the breath-sounds normal or somewhat feeb these cases the inspiration will be harsh, or feeble, or jerk like a dry click. The expiration will be prolonged, owing t impaired elasticity of the lung. The vocal resonance is incre All these auscultatory signs are due to the catarrh of the sma bronchi, or of the alveoli, caused by the presence of tubercles in surrounding parts or to infiltration or pneumonic induration. many cases, in addition, a distinct anæmic systolic murmur may b heard beneath the clavicles, and more particularly on the right side. Localised pleuritic friction sound is often heard.

In Advanced Cases the catarrh attacks the peribronchial and alveolar tissues, and the tubercles coalesce. The inflammatory consolidations of old and recent date are extensive. Induration and shrinking of the lung tissue, bronchiectatic dilatations, and cavities due to breaking down of cheesy infiltrations exist in the apices. The physical signs of this stage are very characteristic.

Inspection.—There is well marked depression or flattening of the supra- and infra-clavicular regions on one or both sides. The affected side is often contracted; these changes are due to induration and shrinking of the apex of the lung, and also to the fact that the indurated lung is not permeable by air, and therefore does not expand under the action of the inspiratory muscles. The chest walls fall in to fill the space. The respiratory movements in the upper part of the chest are defective, owing to the adhesion and thickening of the pleural surfaces over the infiltrated or shrunken portion of the lung. The impulse of the heart is generally diffused, while the apex may be tilted up by the contraction of the cavities. The heart may be shifted to the left or to the right side, according as the mischief is in the left or the right lung.

Percussion.—This yields a perfectly dull sound, owing to the lung-tissue being thick and solid from peribronchial and alveolar infiltration and fibroid development. Percussion, however, may be normal or there may be even slight hyper-resonance, if the tubercles or consolidations are small, and are surrounded by emphysematous or relaxed lung. A peculiar percussion sound known as tympanitic often occurs. Its presence denotes excavation of the lung substance, or accumulation of air in the pleural cavity, or that the tension of the lung tissue is diminished.

Auscultation.—When the consolidation or the tubercular nodules begin to soften down there are distinct clicky râles heard, especially over the apex. Over the dull portions there is coarse crepitation mingled with abundant moist râles. These are generally increased after a cough. The respiratory murmur may be very feeble or altogether masked by these moist sounds. Over the unaffected portion of the lung the breathing is puerile, and occasionally bronchial breathing may be heard over the diseased apex.

In Cavities due to any cause, where the softened tubercles or the inflammatory products which have undergone disintegration are eliminated or the lung-tissue destroyed, the physical signs are well marked and characteristic.

Inspection.—There is well-marked depression or falling in below the clavicle. The whole of the affected side is flattened and contracted. The intercostal spaces are also much narrowed. These changes are due to the contraction of cavities.

The respiratory movements are defective, owing to the adhesion of the pleural surfaces over portions of the excavated lung preventing or resisting expansion of the chest.

Percussion.—It affords either a dull sound, owing to dense or solid lung forming an intervening layer or a wall of the cavity, or a cracked-pot or a tympanitic sound, where the wall is thin and the cavity freely communicates with the bronchi and mouth. The pitch of a percussion sound becomes higher on the patient opening the mouth; is lower when the mouth is shut, and lower still when the nostrils are also closed. Amphoric resonance may be produced in cases of cavities which are large, filled with air, and possess smooth walls.

Auscultation.—Bronchophony and sonorous râles exist in cases of large cavities, which are surrounded by extensive indurations, and are near the surface of the lung. Cavernous sounds are frequently heard, and include bronchial breathing. Should the cavity be very large and hollow the cavernous or amphoric breathing sound is heard, attended by metallic râles or tinkling, when the cavity also contains fluid. Coarse moist râles are heard, especially at the apices, where the cavities are small and numerous. These râles increase and become cavernous or gurgling as the cavities begin to coalesce and form extensive excavations. Metallic tinkling, or bell sound. This sound is heard in cases where the cavities are large, are lined with smooth walls, contain fluid, and are near the surface of the lung. Another sign of cavities is a well-marked pectoriloquy, or loud bronchophony. This sound is heard when the cavities are few and large.

Prognosis.—Much depends upon the stage of the disease and upon the extent of mischief in the lung. Stage of the disease: At an early period, when the cause is obvious, the disease in its infancy, commencing in the bronchial catarrhal form, and confined to the apex of one lung, the progress is very often entirely arrested. If the case be carefully diagnosed and properly treated its future course may prove hopeful, the fever ceases, and the patient gains in flesh and increases in weight. Chronic cases often last for years, even though there may be considerable loss of lung substance. In them much depends upon the constitution of the patient, upon the intensity of the inflammatory processes, and upon the susceptibility of the tissue of the lung involved. In pure pneumonic cases the patient may live for years, and, even with extensive cavities, may enjoy better health than those with pure tubercular disease, even in the early stage of the process. In chronic pneumonic cases the irremediably diseased portion of the lung is cleared out by expectoration, but in the tubercular form the infection still remains, and forms a centre of fresh irritation, which continually breaks down the lung tissue, and may even infect other organs, as the larynx and intestine. In acute cases, whether of the pneumonic or the tubercular form, there is rapid wasting of the body, the destruction of the lung is continually extending, and the prognosis is very unfavorable. Sometimes, however, acute cases, after a certain loss of lung substance has occurred, become chronic or remain stationary for years. The acute symptoms subside, and the patients gain flesh, although there may be consolidation and softening, with cavities at the apex of the lung. The immediate prognosis will depend upon the condition of the remaining portion of the affected lung at the time, and upon the integrity of the opposite lung.

Where the disease is due to bronchial catarrh, or to causes which can be removed or remedied, the chances of recovery are great. The absence of marked physical signs, the late appearance of local flattening, the disappearance of moist sounds, which have been considerable, the presence of slight dulness and a few crepitations give ground for hope that the disease may be checked. It is often noticed that the progress of the disease is delayed for a time during pregnancy, but after delivery the symptoms rapidly grow worse.

If the disease be inherited, if there be evidences of scrofula or of the tuberculous diathesis, if the patient is very feeble or very delicate, the course of the disease is very dangerous. Severe hæmoptysis, continued dyspnœa, harassing cough (owing to the implication of the larynx), and profuse expectoration, are grave signs. So also are high fever, very frequent pulse, incapacity for work, rapid and progressive emaciation, and profuse night sweats. All these symptoms, especially if associated with improper hygienic conditions, insufficient food, or derangement of the digestive system, and persistent diarrhœa, indicate immediate danger. The appearance of thrush has been already alluded to.

A few words must be added about the prognosis with reference to cavities in the lung. Where the cavities are few, small, and quiescent, the patient may live for years. With large-sized cavities, having a tendency to extend, the danger is great. In cases where the cavities are quiescent at first, but after a time begin to extend, death is very rapid, and the danger increases if the patient is also exposed to various depressing influences, as cold, &c., or suffers from erysipelas.

Duration.—It varies in different cases, and depends upon the intensity of the processes, upon the constitution and circumstances of the patient, and upon the general symptoms, as the emaciation, pyrexia, temperature, and quantity of expectoration. In acute phthisis the duration is ordinarily about six months. In chronic cases the disease, if progressive, may last for a period varying from eighteen months to two years from the first appearance of the definite signs. When the progress is completely arrested the duration is indefinite.

Modes of death.—Death is often the result of exhaustion due to the continued and rapid consumption of the body by pyrexia. In advanced cases it may be caused by exhaustion due to continued discharge from the cavities, or by apnœa from inability to expectorate. Less often it is caused by the rupture of an aneurism or of a diseased pulmonary vessel in the wall of a cavity. In such cases death is due to profuse hæmorrhage, collapse, or to suffocation owing to the trachea and the bronchi and the air-vesicles being filled with blood. The extension of ulceration from the lung to the pleura, or the perforation of the pleura (pneumothorax), also rapidly ends in death. In complicated cases, death is sometimes due to peritonitis from perforation of the intestine. Ulceration and necrosis of the larynx also sometimes cause death by exhaustion. In rare cases, thrombosis of the pulmonary artery causes lividity and dyspnœa and death results. In consumption the mind is clear to the last, and hopes of recovery continue to the end. Towards the close the suffering is often great. Harassing cough prevents rest at night, and the patient is obliged to be propped up in bed. He is unable to lie on the side without cough. The emaciation and pressure give him pain in almost every posture. He longs for death, but the end is often long in coming.

Treatment.—This includes (*a*) *general,* and (*b*) *special* remedial measures.

General treatment.—As the disease often commences with general debility, or in constitutions weakened by various excesses, endeavours must be made to abolish such morbid tendencies and to strengthen the constitution. Delicate children and those born of consumptive mothers, should not be suckled by them, but should either have wet nurses or be kept on milk alone for a very long time.

In young girls and in others in delicate health, continuous indoor work, especially if carried on in a stooping posture for several hours every day, is a fruitful source of consumption. Overcrowding in small and close rooms, ill-ventilated and containing too much furniture, should be particularly avoided. Persons with a tendency to phthisis, if disposed to bronchial catarrh, should avoid exposure of the skin to chills, and should always wear flannel. In these cases bronchitis is apt to be protracted, and frequently to recur and may ultimately lead to phthisis. When a patient is suffering from acute catarrh of the smaller bronchi, he should at once be confined to bed, have counter-irritation as blisters, linseed or mustard poultices to the chest, while the fever is combated by antipyretics, as quinine and digitalis, and by diaphoretics, as sweet spirit of nitre. Such patients should always avoid exposure to draughts of cold air, and the inhalation of an atmosphere containing dust of any metal, or of flax, cotton, or any other irritant. Early hours and avoidance of dissipation in every form must be strictly enjoined.

In cachectic or weakly persons predisposed to bronchial catarrh, the tissue being weak, hyperæmia of the lung very commonly occurs. To such patients violent exercise as running, dancing, or singing should be forbidden. They should abstain from all abuse of spirituous drinks, and from tobacco. When such patients grow weak and thin without any assignable cause they should be subjected to a long course of tonics, as quinine, mineral acids, iron, and arsenic. If night sweats are common small doses of strychnia may be given with benefit. As the disease is often associated with the scrofulous diathesis, persons when beginning to suffer from caseous degeneration of the lymphatic glands should take for a long time a combination of iodide of iron and cod-liver oil, or the preparations of phosphorus and sulphur, drugs reputed as blood-purifiers. In every case where phthisis is suspected, attention must be directed to check as far as practicable the disintegration of the albumenoid tissues of the body, and to remove all those causes which tend to diminish the normal amount of fat in the blood. Such patients rapidly emaciate, and there is soon a deficient amount of fat in the body. An increased supply is therefore indicated, and this can be furnished in the shape of cream, or solid fat, or cod-liver oil. As the function of the pancreas is in abeyance, some preparation, such as pancreatic emulsion, may be given with advantage. The digestion must be improved by mineral and vegetable tonics, diluted mineral acids, &c. The diet should be nutritious and easily digestible ; spices and other irritants to the mucous tract should be avoided. An atmosphere rich in oxygen and a climate cold but dry are the most suitable meteorological conditions. All depressing nervous or vital influences should be avoided. Cheerful society and easy pleasant occupations have a beneficial effect. The skin should be kept scrupulously clean.

In cases of bronchial catarrh which grow worse during the winter and milder during summer, the patients should live indoors during cold weather and may even try a respirator.

Special treatment.—In a large majority of cases much may be done to arrest the course of the disorder. The disease being often secondary to other lesions, attention to hygienic laws will be of immense benefit. Recovery takes place in a certain number of cases. In many cases, if the disease be early diagnosed and properly treated, its progress can be partially or even entirely arrested. When the cause of the mischief, or the circumstances which give rise to it, can be removed or modified, there is still greater hope for a more or less complete cure. The disease when once established consists of inflammatory processes and the results of the irritative action of tubercles in the lung. Our endeavours should be directed towards controlling these processes and preventing their further progress in the lung. In the early stage under judicious management, patients generally improve for a time. Proper rest to the body and lungs is necessary till the inflammatory process has subsided, and the fits of shivering and even rigors which precede evening exacerbations and other febrile symptoms have been lessened in severity and frequency. To check the tendency of the disease towards further progress it is absolutely necessary to avoid such occupations as require inhalation of foul and irritating vapours or gases. The patient should avoid exposure of the body to draughts of cold air and to moisture, especially after fatiguing exercise. Attention must be paid to all hygienic laws, and to sanitation as regards drainage and soil. The thorough and efficient system of drainage now in the course of construction in Bombay will, it is hoped, prove of great benefit in diminishing the rate of mortality in phthisical patients. This result has been attained in many parts of England, where before the new drainage system was introduced the rate of mortality was very high. Various resolvent remedies as blisters, plasters, and various irritating ointments are useful for promoting the absorption of the inflammatory products in the lung. These have proved to be efficacious in the early stage of phthisis. Other medicinal agents are useful to save the tissues from disintegration, to supply the materials for the generation of animal heat, and to improve the state of the blood. Thus cod-liver oil, and fat should be given, and continued for a very long time. Waste may be checked by supplying alcohol in some form or other. It acts as a stimulant, promotes circulation and digestion. The latter should also be improved by mineral acids and strychnine.

Attention must next be directed towards remedying the existing inflammatory processes in their advanced stages. These latter consist in degeneration and softening down of the inflammatory products, and in suppurative processes in the disintegrated lung. All antiseptic drugs, if fairly tried, will tend to subdue the suppurative processes. The antiseptic treatment of consumption has been invested with special importance since Dr. Koch's discovery of the infective micro-organisms of this disease. The inhalation of antiseptic vapours has proved very successful in many cases of phthisis. The practice is by no means a new one; the inhalation of the fumes of tar, creasote and turpentine was practised early in the present century. The inhalation of "carbolised" air, and the internal administration of carbolic acid have, however, recently been followed by very remarkable effects. Continuous antiseptic inhalation by means of a respirator is preferable to the use of the spray. The respirator can be very easily constructed; a plate of perforated zinc is a good material. A piece of sponge carries the disinfectant which may be selected. Various drugs may be used for this purpose; the most efficacious are carbolic acid, creasote, turpentine, thymol, terebene, camphor, oil of firwood, tincture of iodine, &c. All these may be used for continuous inhalation. It is a good plan to mix any one of them with an equal part of spirit of chloroform, which has a soothing effect on the bronchial mucous membrane. Twenty minims of a mixture of equal parts of creasote and spirit of chloroform may be dropped on the sponge at one time, or even less may be used till the patient becomes accustomed to the vapour. The inhalations will be found, even in advanced cases, to allay the cough, lessen the amount of expectoration, and diminish the fever.

In the case of cavities the chief aim is to diminish the secretion. This is best obtained by the use of antiseptic inhalations, by supporting the patient's strength and promoting the healthy condition of the body. Locally small flying blisters and iodine paint over the suspected regions of the chest are very efficacious. The suppurative matter once formed should not be allowed to remain longer in the lung, as it in itself will prove a source of further irritation. Stimulating expectorants are very useful in such cases. In order to promote a healthy action of the cavity, disinfectant or antiseptic inhalations are the best remedies. Complications should be combated as they arise. Diarrhœa can be checked by opium and other astringents. Hoarseness of voice is generally irremediable.

In advanced cases where the patients are reduced almost to skeletons by shock, asphyxia, or exhaustion, life is very often threatened. Shock may be due to opening of the cavity into the pleura, or to rupture of the intestine into the peritoneum, and such complications must be treated by stimulants and opiates which relieve the sense of dyspnœa and calm the exhausted nervous system.

In a large majority of cases the patients ultimately succumb to the effects of the disease. Sometimes, however, a steady improvement sets in, and the disease is either arrested or entirely cured. The great advantage of a change to a high altitude is often seen. The patients should take daily exercise in the open air, and thus strengthen and develop their muscles. In such patients after a short residence at high altitudes the temperature chart points at first to a steady elevation of the blood-heat, and the pulse increases in frequency. Gradually, however, the blood-heat becomes normal, and the pulse also reduced in frequency. The beneficial effects of a change on the consumptive is further seen in the glow of the complexion, showing an increase in the number of corpuscles in the blood, and a further gain in health. The air at high altitudes being more rarefied than in the plains, more has to be taken to supply the needs of the system, and therefore the respirations, which in phthisical cases are generally frequent, become more so, and their depth is also increased. After a long residence in elevated places, a gradual expansion of the previously diseased portion of the lung occurs. The upper part of the affected lung which, owing to deposit in it, had less work before, now begins to expand unless cavities are formed in it. The aërating surfaces, owing to the constant tide of air flowing in and out, now become more active and more healthy, and a sort of healthy vesicular emphysema sets in around the diseased portion. As a result, the chest is widened. This is due to the expansion of its muscular walls from internal pressure. The widening is more marked in the upper regions than in the lower. Thus the lungs improve, the respirations gain in depth, and they gradually become less and less frequent till they return to their normal standard. The houses which the patients inhabit should be well ventilated and well drained, built on a dry soil, such as sand or gravel, and sheltered from cold winds. The bedrooms should be lofty, and the windows should admit all the sunlight possible. Where change is impracticable, patients should take exercise in the open air, short of fatigue. In Bombay it should be taken every morning and evening in the open air over the Back Bay, or on the Malabar Hill, close to the beach. The air should be free from fog or cold and damp vapours and all irritating or foul effluvia. In persons threatened with consumption, residence at high altitudes, and particularly at moderate elevations, has been proved to be of immense benefit. Such a change of climate is known to have a bracing effect on the system. In phthisical cases it causes rapid diminution and ultimate cessation of night-sweats, it improves the appetite and promotes digestion, and the patients gain in flesh. A large number of the sick, in their earliest stage removed to Matheran, Mahableshwar, or sent to Singapore or Kurrachee by sea, have, after spending the whole summer in those hilly places or on the open sea, returned considerably improved and having gained flesh and strength.

Diet.—Another equally important agent for the cure and arrest of phthisis is alimentation. Great care is necessary in the selection of food for invalids. It should be very nutritious, and in a concentrated form, so that it may be introduced in as large a quantity as can be readily digested. Any irritating spices should be avoided. Fatty and starchy diet, as cream, butter, &c., are absolutely necessary. Meat with fresh vegetables should form the principal meal, and sago with plenty of milk may be taken every morning, along with butter and salt. Koumiss and whey are serviceable, and their use should also be encouraged. As the digestion is generally weak, various preparations of pepsine are often valuable aids.

Baths.—Where cold baths agree they should always be prescribed. They are very invigorating when followed by a glow. For weakly patients tepid baths must be substituted. Sea-bathing is very useful. The practice among the Hindus to bathe in open places and to allow wet clothes to remain on the body is very injurious. Their custom of bathing in the sea or in their temples and then returning to their respective homes in a wet state is fraught with danger. Consumptive patients are more liable to catarrh on the slightest exposure than ordinary persons. During winter they should always wear a wrapper round their necks, and should have clothing of wool or flannel next to the skin.

Exercise.—Free exercise in the open air, as in walking, is advisable if the patient is in the early stage of the disease and has had no fever, no hæmoptysis. Riding exercise is excellent in a few cases. Where the disease is more advanced and extensive, carriage drives must be substituted, and a sea voyage will often do good.

In every case attention must be paid to the relief of the existing symptoms. Thus *pain* in the chest is best remedied by giving rest to the affected lung or pleura. For this purpose the affected side is to be strapped up by means of sticking plaster. When this plan has been adopted, the patients often become able to breathe and cough without pain; sometimes a flannel bandage round the painful part or a mustard plaster is useful. Where all these remedies fail, a belladonna plaster, or some anodyne embrocation, as liniment of opium and belladonna, or counter-irritation by means of iodine paint or even a small blister may be prescribed. The pain may also be relieved by turpentine stupes or stimulating liniments, as the liniment of ammonia, the compound liniment of mustard, or by croton oil, or the tartar emetic ointment rubbed in from time to time.

Hurried breathing and dyspnœa.—Hurried breathing may be relieved by diffusible stimulants as carbonate of ammonia or sulphuric ether. Where the breathing is embarrassed, small doses of strychnia, which is supposed to act as a powerful stimulant to the respiratory centres, may be prescribed. The spirit of lavender is also useful for the relief of hurried breathing in a few cases. Nitrite of sodium in grain doses will lessen the frequency of respiration. It should be combined with digitalis.

Cough.—It is generally very troublesome. When frequent, dry, and irritable, and the expectoration difficult, the latter must be promoted, and the bronchial membrane soothed by a combination of demulcents with expectorants, as ipecacuanha. In chronic cases, and especially in fibroid phthisis, the cough is paroxysmal. It is best allayed by a combination of chloroform with very small doses of morphia. If along with the irritating cough the voice has become hoarse, the throat or the larynx should be treated by local anodynes; if the cough prevents sleep, the patient should be encouraged to check it as much as possible. He should further be aided by the internal administration of anodyne cough-mixtures, containing the tinctures of hops, hyoscyamus, conium or lactucarium. Croton chloral is superior to hydrate of chloral and may be given to relieve distressing night cough. The expectoration may be promoted by the addition of minim doses of ipecacuanha wine, repeatedly given till the irritation is completely removed. To procure sleep, and at the same time to allay the troublesome cough, a few grains of Dover's powder, or a drachm dose of paregoric elixir combined with 15 or 20 grains of bromide of potassium or the hydrate of chloral may be given. Where the expectoration is retained owing to the loss of power of the bronchial muscles, sedatives should be altogether avoided, as under their influence the retained products set up fresh irritation and also considerably impede respiration. In chronic cases, where the cough is very troublesome and the secretion is profuse without any active symptoms, various preparations of tar are useful in lessening the expectoration. Inhalations of simple steam, or of the various antiseptics mentioned in a previous page, as creasote, tar, carbolic acid, tincture of benzoin, iodine vapour, or even of turpentine seem to be the best local remedies to relieve the cough and to diminish the amount and fœtor of the sputa, which are generally offensive. In some cases, the internal administration of ½ drachm doses of turpentine or of balsam of copaiba combined with 10 minim-doses of the tincture of belladonna, and with ether and ammonia, given every three or four hours, has proved of immense benefit. If the cough is convulsive and dry, sedative inhalations of conium, chloroform or cannabis are likely to give relief.

Fever.—This symptom is generally obstinate, and when severe is most exhausting to the patient, more so even than the expectoration of pus or mucus. All those remedies which lessen abnormal heat, as aconite, digitalis, and veratria have been prescribed with benefit; a combination of digitalis with opium and quinine is very serviceable. Other remedies which promote the functions of the skin and kidneys, as various diaphoretics and diuretics, have been given. To lessen blood-heat, cold applications to the skin, as cold compresses to the chest, or cold baths or wet sheets, are also useful.

Where the fever is dependent upon some form of purulent absorption, as in suppurative processes, or upon some morbid poison as in acute tubercular cases, and in cases of pneumono-tubercular phthisis, quinine in large doses, effervescing salines, and the preparations of salicin have been given with good results. Arsenic in the form of Fowler's solution may also be given in 2 minim-doses three times a day, if the temperature is under 102°.

Night-sweats.—Waller's acid is very useful. Quinine in 2 or 3 grain-doses, combined with 9 or 10 minims of diluted hydrochloric or of nitric acid, helps to check the sweats. They can also be subdued by small doses of oxide of zinc, or of the tincture of belladonna, or of atropia and ergot combined. Pilocarpine, in one-twentieth of a grain doses may be given every four or six hours with good effects. Picrotoxine in $\frac{1}{150}$th of a grain is said to produce similar results. The injection of atropine $\frac{1}{100}$th of a grain or the internal administration of one-fiftieth of a grain will check profuse night-sweats. The natives apply to the surface of the skin powdered ginger or the kinitola powder or ashes from burnt wood.

Chills. — To prevent their recurrence arsenic in the form of Fowler's solution is useful; it may be given in 5 minim-doses three times a day with meals.

Emaciation and debility.—These are the results of fever, defective digestion, and night-sweats, the occurrence of which can best be prevented by sustaining the patient's strength by a course of tonics, as quinine in 1 grain or 2 grain doses combined with mineral acids, as the diluted nitric, phosphoric or hydrochloric. Such a course of treatment, if continued for a long time, improves the general condition of the patient. Arsenic is sometimes equally beneficial in these cases. Fowler's solution from 3 to 5 drops may be given with some bitter infusion three times a day after meals. Other preparations of arsenic, as the arseniate of soda or the arseniate of iron, may be substituted for the arsenite of potash. Cod-liver oil is of course to be given; its use will be afterwards referred to.

Hæmoptysis.—At the commencement, perfect rest to the lung and body will be necessary, and it will often effect a cure. The patient must be kept on his back and in bed. If the hæmorrhage persists, astringents which diminish the calibre of the vessels and which act by contracting the muscular walls of arteries, should be given. These are gallic acid and tincture of ergot. They may be given in half-drachm doses and repeated as required. The hypodermic injection of one grain of ergotine is also very useful. Ipecacuanha and other nauseating remedies are also serviceable in these cases. Turpentine is given internally with a view to give tone to the pulmonary vessels. Ice locally applied to the chest and given to suck also acts beneficially. Diluted nitro-muriatic acid has also been given with success. As congestion of the pulmonary vessels often leads to hæmorrhage, violent exercise should be avoided in all cases where there is a tendency to hæmoptysis. Girls particularly should be cautioned to abstain from dancing or singing. The use of stimulants should be deprecated. When the hæmorrhage is very profuse, so that the blood coagulates in the lung, the patient faints and there is irritating cough. Digitalis, which diminishes the frequency of the heart's action, may be given combined with opium, which lessens the excitability. Opium is also useful to allay cough in these cases.

Hoarseness of voice.—The treatment of this symptom is very unsatisfactory. In the early stage of commencing hoarseness the neck should be covered with flannel to keep it warm. Locally, counter-irritants, as small flying blisters, about the size of a florin, over the region of the larynx, or mustard poultices, or the inhalation of hot steam, or of steam medicated with turpentine or belladonna or liquid ammonia may be tried. Sedative inhalations, as of hyoscyamus or of conium and cannabis, are also useful where there is much irritation. In a few cases nauseating doses of ipecacuanha, or a spray of it directly applied to the larynx, will be found to relieve pain and distress. When ulcers have formed, antiseptic inhalations are generally useful. In such cases also, tannin and glycerine, or a strong solution of nitrate of silver or of sulphate of copper may be applied to the ulcers. Notwithstanding all our efforts, death takes place very rapidly in these cases.

Diarrhœa.—It often alternates with constipation and colicky pains. Where due to irritating materials overloading the bowels, as discovered by the exploration of the abdomen and by the appearance of the secretions, a dose of castor-oil, or a little rhubarb and magnesia, or aloes with belladonna, or ipecacuanha and belladonna, may be given with good results. Where the diarrhœa is due to intestinal catarrh, caused by irritation of the mucous membrane, it should be checked by soothing astringent remedies. A few grains of grey powder and Dover's powder combined with aromatic chalk powder, will check the looseness. Under their use the motions change; they become natural and constipation may follow. In acute cases, fifteen grains of subnitrate of bismuth with ten grains of the carbonate of soda and an equal quantity of prepared chalk mixed with mucilage may be given with benefit. If there be pain, ten minims of tincture of opium may be added to the mixture. Sometimes ten grains of bismuth and six grains of

Dover's powder mixed and made into one powder may be given every four hours with benefit. Where these remedies fail hæmatoxylon or the compound Kino powder may be given, combined with bismuth. The natives of Bombay often give in such cases, pills made of pepper, opium, cannabis, and powdered pomegranate bark, beaten up in cinnamon powder, and with the best results. By way of variation in the use of astringents, diluted sulphuric acid and opium, or acetate of lead with opium, may be given where other remedies have failed. Chlorodyne can be tried either alone or in combination with bismuth. The treatment of cases where ulceration has become established is most difficult. In cases of ulceration of the colon aromatic sulphuric acid and opium, or acetate of lead may be tried. Enemata of acetate of lead and opium, or opium suppositories may also be employed with advantage. One or two drops of Liquor Arsenicalis given before each meal is useful in such chronic forms. In long-standing cases, small doses of ipecacuanha or minim doses of ipecacuanha wine sometimes act with benefit. Where one astringent fails another often succeeds, and hence the necessity of trying first one and then another. Enemata of starch and laudanum are often very efficacious in checking diarrhœa due to tubercular ulceration. In all cases, rest to the bowels is imperatively necessary. This is best effected by the administration of opium, and keeping the patient in bed. Diet is all-important. The patient should be restricted to such diet as may give as little trouble as possible to the bowel to digest. The food should be of a nature suitable for gastric digestion. Broths and gruel should be avoided. Extract of malt, white of eggs, milk, and arrowroot or cornflour may be recommended, as these are digested with the least amount of trouble to the bowels. Among the stimulants port wine and brandy are the best. Rum or brandy may be given combined with milk and eggs. Where patients complain of pain in the abdomen and flatulence, turpentine stupes, and warm or hot mustard and wheat flour poultices, or linseed poultices alone, may be applied. Charcoal biscuits given alone or with bismuth lozenges often afford speedy relief to flatulent colic.

In every case of phthisis, where the bowels are loaded and there is constipation, the treatment by purgatives is fraught with the greatest danger. Perforation is very apt to occur in ulcerative cases where jalap or colocynth or podophyllin is administered. These drugs must, therefore, be avoided, and enemata or very mild purgatives should be selected.

In cases of diarrhœa, kept up by excessive intestinal secretions, antacids, such as carbonate of soda and astringents with carminatives, are highly beneficial. Of all astringents opium is to be preferred. Other astringents, as nitrate of silver, tannin, preparations of iron, and vegetable astringents, as catechu, krameria, &c., may be tried with advantage. After the diarrhœa is once checked remedies should be used to give tone to the intestines. For this purpose small doses of strychnia, vegetable bitters, and diluted mineral acids and pepsine are to be recommended. When ulcers exist antiseptics, as charcoal, creasote, or carbolic acid should be used, as these remedies prevent further putrefactive changes and improve the condition of the mucous membrane. Capsicum is sometimes a specific for diarrhœa where other remedies fail. Cauterisation over the abdomen by a red-hot iron, or by means of a physic nut sometimes gives speedy relief to the pain.

The colicky pain may also be relieved by the subcutaneous injection of $\frac{1}{6}$th grain of morphia and $\frac{1}{100}$th grain of atropine. Pills made up of two or three grains of oxide of zinc also relieve pain and tenderness.

Deranged digestion.—This is best improved by the administration of alkalies and vegetable bitters and tonics, as strychnia and bark. Arsenic is very useful if the tongue be red, with prominent papillæ at the tip, and smooth or slightly furred all over. It may be given in two- or three-drop doses of the Liquor Arsenicalis shortly before food.

Arsenic has been proved to be highly beneficial. Under its use the appetite improves; the food is well assimilated; the cough and expectoration become less; even the temperature chart shows a steady and sustained diminution of fever heat. Such marked improvement is a rare effect of any other drug. The hakeems freely use it, and children and adults are known to recover. It may also be given in one- to two-drop doses every three or four hours.

A few remarks on various remedies used in the general treatment of consumption will conclude this part of the subject.

Blisters.—These are very beneficial in chronic and fibroid phthisis. In acute cases and in galloping phthisis they are useful only to relieve pain. In chronic cases, under their application, there is often immense relief from violent or distressing cough, and rest and sleep are procured. Under their use the profuse expectoration which causes a great drain upon the system is lessened. In weakly patients iodine liniment should be preferred to vesication by blisters. Croton-oil liniment is highly useful, and is more efficacious than mustard poultices.

Drugs.—Those most useful in recent pulmonary cavities act by checking the progress of purulent formation. These are quinine, arsenic, salicylic acid, &c.

Quinine.—This drug is very useful to sustain the patient's strength, to increase the appetite, and to lessen night sweats. It is given in doses of gr. ij to gr. iij, combined with ♏v to ♏x of diluted nitric or hydrochloric acid.

Iron.—The phosphates are especially useful as the exudation products have removed them from the blood. In any of its forms it is of immense benefit. The ammonio-citrate and the arseniate are suitable for many cases.

Arsenic.—This drug manifests its effects in improving the general condition of the patient, and in preventing the occurrence of chills. It is given in doses from ♏iij to ♏vij, of Fowler's solution, three times a day and after meals. Another preparation, equally useful, is the arseniate of soda in solution, and in similar doses. The arseniate of iron, in half-grain doses, is equally beneficial.

Bichloride of mercury.—It is very frequently prescribed by the Bombay hakeems. It is given in very small doses, and often with very favorable results.

Salicylic acid.—It is very advantageously given in cases of recent cavities. Under its use the temperature falls many degrees. Patients gain flesh and increase in weight, and assume a ruddy look, showing an increase of red corpuscles in the blood. The amount of cough and expectoration is also diminished. It is given in twenty-grain doses every four hours till the temperature becomes normal. After this, if its further use tends to reduce the temperature considerably below the normal degree, its administration should be stopped. In cases with moderate fevers its effects are very lasting. The temperature falls and does not rise again to its former original height. The weight of the patient is also somewhat increased.

Cod-liver oil.—Very often a long course of the oil is found to be associated with a steady progress of the disease and decline of the patient's health. There are, again, some cases in which the oil may have been tolerated at first, but on subsequent repetition its use cannot be persevered with. In acute tuberculosis, and in galloping phthisis, where the temperature of the body remains high, the oil should be given with great caution. In such cases the digestion is generally disordered, and the oil soon tends to still further disordering it. In chronic cases it is well borne. If diarrhœa exists, it should be given in very small doses and only once a day or only twice or thrice a week. If a teaspoonful be given the last thing at night before going to bed it will often cause diarrhœa. It should be given for a very long time. Cod-liver oil is given internally with a view that it may be absorbed by the portal system of veins and it is sometimes rubbed into the surface of the body and made to be absorbed by the skin. The oil has been extensively used by [illegible] [illegible] and [illegible] is for a very long time. Different patients bear the oil differently. Some prefer the brown, others the pale. It is best tolerated when given after a meal. Where it is disagreeable it is often combined with milk, or taken floating on orange-wine. With some stomachs it always disagrees. In them other medicinal agents, as pancreatic emulsion, or almond oil, or curds, or cream and ghee may be substituted. The natives of Bombay give medicinally small doses of corrosive sublimate, or large doses of arsenic in these cases, to be followed by curd and ghee along with their meals. Under their use many patients rapidly improve in weight, and often grow fat. Few persons can take more than four to eight drachms of the oil every day and from week to week without any interruption. Very often the effects are not permanent. In some the oil does not benefit at all when first administered, but the renewed exhibition, after it has been withdrawn for some time, produces very beneficial effects.

Hypophosphite of lime and hypophosphite of soda are very beneficial in the early stages of phthisis. They are given in five-grain doses three times a day, and under their use digestion and assimilation improve, the exhausting cough and wearing expectoration diminish. Any existing diarrhœa is also lessened.

Alcohol.—The practice of giving two to four drachms of rum with a glassful of fresh cows' or asses' milk or cream has proved undoubtedly useful in many cases. It is to be recommended in the early stages; under its continued use the appetite improves and patients gain in strength. Very often large doses can be tolerated with impunity in this disease.

Vegetable tonics are very useful; they promote appetite and assist digestion.

Pancreatic emulsion.—It is useful as supplying a large amount of fat readily prepared to the blood. It is thus absorbed in the intestines. The average quantity taken by each patient varies from two to six drachms in half a pint of milk. It can be continued for eight or ten weeks. Ether is very often mixed with cod-liver oil. Ether is capable of stimulating the secretion of the pancreas, and hence it is a very useful agent in the assimilation of fats. It also promotes absorption of fat.

Maltine, or extract of malted barley or wheat, is largely used in phthisis. Its analysis shows that it contains malt-sugar, and dextrine. It is given in doses of a table-spoonful with milk. Preparations which contain much gluten, as rye meal, lentils, &c., have obtained a high repute in phthisis. *Chaulmoogra oil* in ten-minim doses has been given freely by the natives in early cases.

Milk forms a very suitable article of diet for consumptive patients. It contains a large quantity of fat or fat generating matter, and a small proportion of protein substances. Under its use the excessive production of urea, which is due to destructive assimilation and consumption of the most important organs in the body is avoided. Fresh good milk from the cow or asses' milk is very desirable. Koumiss is very nutritive, and may be given where the stomach is very irritable, prostration extreme, and the expectoration profuse and exhausting.

Treatment of fibroid phthisis.—In chronic cases of phthisis, known as fibrosis of the lung, there are often long periods of quiescence, lasting for several months, and even years, the patient suffering mainly from slight irritative morning cough. These cases can best be treated by avoiding all causes of fresh catarrhs, by attention to hygiene and to climate at different and suitable seasons of the year. In this part of India, such patients may prolong their lives by a residence in Poona during the months of June, July, August, and September, in Khandalla for October, November, December, and January, and in Matheran, or Mahableshwar, or in the Nilgherries during the months of February, March, April, and May. Under these circumstances such patients may improve immensely, with an occasional administration of tonics (iron) and cod-liver oil, aided by nourishing diet. They increase in weight and improve in complexion. Excessive use of iron and oil and indulgence in too rich and stimulating food, when the patient does not require it, very often lead to plethora and renewal of fever, and liability to congestion of the lungs, and even to hæmoptysis. With this renewal of the old disease the patient often dies. Patients with quiescent cavities, under provocation of depressing causes, often get worse very rapidly; the fever is high and attended with typhoid symptoms; the expectoration is also profuse and fœtid, and often mixed with blood. In such cases quinine combined with the tincture of the perchloride of iron, and sedative inhalations of benzoin, opium, or hyoscyamus, or of chloroform, or carbolic acid, are likely to be useful. Ipecacuanha spray (either the aqueous solution or the wine) may be worth a trial. The strength must be supported, and stimulants, as musk, ether, brandy, or champagne, with liquid and nourishing diet, are urgently demanded. The room should be thoroughly ventilated, and fresh air freely admitted, and, after such treatment, if the patient rallies, and the fever abates, but the character of the expectoration continues to indicate increased vascularity of the cavities, flying blisters over the seat of the affected cavity will be of immense benefit. Under their use the expectoration generally changes and becomes less in quantity and improves in quality, and the blood disappears.

CANCER OF THE LUNGS.

The causes are unknown. The disease is rare, and when it occurs is usually medullary. Encephaloid cancer of the lung is sometimes secondary to cancer of the breast; sometimes it is an accompaniment of cancer of the liver. It is rarely a primary affection. It sometimes originates from the bronchial glands, and then one or both lungs may be attacked, the right one more commonly than the left. Cancer in the lung originates from conversion of the connective-tissue cells of the matrix and of a few epithelial cells of the alveoli into cancer cells. The disease is thus propagated from one portion to another. Where the cancer is isolated, the conversion into cancer cells is only limited. In either case the parenchyma of the lung is uninjured, it being only compressed by the cells. It is extremely soft, pulpy, and vascular.

Post-mortem appearances.—Secondary cancer is generally nodular, while primary cancer more often infiltrates the lung. It extends into the pleura, and through the pleural folds spreads into the chest walls, and may appear externally.

Symptoms.—There are no characteristic symptoms. There is generally a history of cancer of the breast or of some other part of the body. The symptoms relate to some chronic disease of the lung, and there is dyspnœa on exertion, pain in the chest, accompanied with tenderness, emaciation, night-sweats, cough, with purulent and dark-coloured expectoration often resembling black-currant jelly. Hæmoptysis is very common.

Physical signs.—The same as of tubercles coalesced. In the case of tubercle the disease is usually confined to the apex, and the physical signs relate to the diseased condition of the upper part of the chest. In cancer there are signs of consolidation, but not always at the apex. When the disease is primary, there is on the affected side impaired respiratory movement and dulness on percussion. In cases of nodular cancer there is a circumscribed enlargement, the surface feeling unusually even. There is also complete absence of respiratory movement, absolute dulness on percussion, and great resistance.

Termination.—It has a tendency to set up destructive inflammatory changes in the surrounding portion of the lung. Hence hyperæmia and œdema are common. Death occurs from asphyxia or from asthenia, from exhaustion or hæmorrhage.

Treatment.—This of course is only palliative. Nothing can be done to remedy the cancer. Attempts must be made to relieve the symptoms as they arise. The patient's strength must be supported by nourishing diet and stimulants. The disease is always fatal.

SYPHILITIC AFFECTIONS OF THE LUNGS.

The lung is the occasional seat of syphilitic lesions, both in the earlier and the later stages of the disease. The eruption is sometimes preceded or accompanied by symptoms of irritation of the bronchial mucous membrane, and these occasionally assume a severe form. When the eruption becomes fully developed the chest-symptoms, as a general rule, either disappear or are much lessened. This affection of the bronchi is analogous to that which so often accompanies the eruptive stage of the exanthemata. In a few cases the sudden disappearance of a syphilitic eruption has been followed by severe symptoms of bronchitis and fever. These phenomena usually subside under active diaphoretic treatment, which has the effect of restoring the cutaneous eruption. No doubt can exist that the bronchial affection is connected with the syphilitic poison. The bronchitis is sometimes persistent and is attended with debility, night-sweats, emaciation, and copious muco-purulent expectoration. The symptoms may closely resemble those of phthisis, but neither cavities nor consolidation will be detected, and the constitutional symptoms will be disproportionate to the physical signs.

In the later stages, the syphilitic lung-affections take the form of fibroid indurations and gummatous formations. These conditions may exist in the lungs alone, or may have extended from the pleura or the bronchi.

When the disease extends from the bronchi, it generally takes the form of callous induration affecting small nodules, and the base and root of the lung are the parts mainly affected. There is no softening or caseous change; the pleura is generally puckered in various directions. The disease resembles fibroid pneumonia, and consists of induration of the connective tissue surrounding the branches of the pulmonary and bronchial arteries.

The lung is the occasional seat of gummatous growths which are found in various stages of development. The middle and lower lobes are the parts most often affected. The tumours are generally few in number, and whitish or yellowish in colour. They vary in size from that of a pea to that of a walnut. They usually remain isolated, and when softening takes place do not break down altogether, owing to the firm fibrous layer which surrounds them; gummatous infiltration sometimes extends from the wall of the thorax to the pleura and lungs.

The *symptoms* of gummata of the lungs resemble those of pulmonary phthisis, but their course is less rapid, and in some cases it has been observed that notwithstanding the severity of the local symptoms the strength of the patient was less affected than in ordinary cases of consumption. The fact that the upper lobes of the lungs are generally unaffected in such cases is one of considerable importance as regards diagnosis. The effect of treatment will likewise aid in indicating the true nature of the case. Some authorities have alluded to the frequency with which laryngeal ulceration coexists with pulmonary syphilis. It must not be forgotten that patients suffering from the laryngeal affection in a severe form often exhibit many of the symptoms of phthisis; but a careful examination will prove that their lungs are free from disease, and all the symptoms will disappear under anti-syphilitic treatment. The diagnosis will, of course, be materially aided by the history of the case, the course of the disease, and the almost invariable coexistence of other symptoms of syphilis.

Miliary tubercles are sometimes found in the lungs associated with gummatous nodules, in various stages of growth and development, and it may therefore be admitted that syphilis is one cause of pulmonary tuberculosis. Syphilis is, in all probability, an important agent in the production of pulmonary disease among English soldiers.

Treatment.—In any given case of pulmonary disease of which syphilis is supposed to be the cause, iodide of potassium is the remedy which is mainly indicated. For cases of syphilitic bronchitis mercury is to be preferred. Quinine, cod-liver oil, and other tonics may also be required if hectic, emaciation, and other evidences of debility be present.

EMPHYSEMA OF THE LUNGS.

Definition.—*Vesicular* emphysema is a disease of the lungs in which the air vesicles are at first dilated, the alveolar septa to a greater or less extent subsequently destroyed, and forming large cysts. When the air vesicles are dilated, they undergo gradual atrophy; when they are perforated, and the air escapes into the interlobular connective tissue, the condition is known as ***interlobular*** emphysema. The disease is generally progressive and chronic.

Causes.—Its cause or mode of origin is uncertain. It may be mechanical, as too long inspiration, or forced expiration; it may be a secondary affection to rigid enlargement of the chest walls, or may be due to nutritive derangements of the lung substance. These are the hypotheses in vogue to account for its occurrence.

(*a*) *Too long inspiration.*—Inspiration kept up for any length of time leads to permanent inflation of the air vesicles, and when continued it ends in structural changes or atrophy of the alveolar walls. This theory well explains the origin of ***substantive*** emphysema in a few cases. It is also applicable in cases of *vicarious* emphysema. In chronic pneumonia affecting one lung the diseased lung is occluded from the action of the air; the other lung becomes compensatorily dilated and emphysematous. Similarly in bronchitis certain air tubes become occluded by mucus, and the inspiratory force is occupied in distending the remaining portion, till the deficiency in the air spaces is compensated.

(*b*) *Forced expiration.*—The expiratory theory is best adapted to explain the origin of substantive emphysema. In cases of violent cough and as a result of loud singing or lifting heavy weights, the thorax is contracted and the glottis is narrowed. The escape of air through the narrowed glottis is impeded, and the air therefore remains in a compressed state, and is driven back in the upper bronchi, or to those portions of the lung which are least supported, as the apices, the anterior margins, and the parts corresponding to the intercostal spaces. In these parts of the lung the compressed air presses upon the air-cells, and they therefore dilate, become distended, and emphysematous.

(*c*) *The rigid enlargement of the chest walls.*—This mode of origin is rare. With it there is generally associated some nutritive changes to account for the distension, wasting, and perforation of the air-cells. In nearly all cases the nutritive changes and the rigid enlargement arise from the same causes. In rigid enlargement of the chest walls there is failure of nutrition or degeneration of the elastic ribs and cartilages, and the enlargement is permanent. This condition, then, causes the enclosed lung to expand and become emphysematous.

(*d*) The *failure of nutrition* damages the lung texture, the elasticity is impaired, and the air vesicles are relaxed. The elasticity of the chest walls tends to expand the chest, and the relaxed lung yields to the traction of the chest wall and the weight of the abdominal organs, and becomes emphysematous.

Varieties.—These are mainly two. Local, secondary, or vicarious, and general, primary, or substantive emphysema. Other modifications may be met with. These are—1. Hypertrophous or large-lunged emphysema. In it the air-cells are dilated, and the condition is associated with great increase in the bulk or capacity of the lungs. It is due to frequent attacks of bronchitis, which diminish the elasticity of the tissue. 2. Atrophous emphysema, as occurs in old people, where the walls of the air-cells are wasted from interstitial decay, and have not the elasticity to dilate. 3. Interlobular emphysema. This occurs as a result of accident or from rupture of air-cells near the surface and interlobular interstices, with subsequent escape of air into the subpleural and interstitial tissue.

tive-tissue. *Local emphysema* is an emphysema affecting a small portion of one or both lungs. It occurs near a spot where a portion of the lung has been wasted or collapsed, or cut off from the air supply. It therefore follows pneumonia, pleurisy, and chronic bronchial catarrh. The first and the last sometimes cause the occlusion of a small piece of the lung-substance from the action of the air. In pleurisy firm adhesions may prevent the expansion of some piece of the lung. In each case it is the part of the healthy lung near or surrounding the occluded or bound-down portions that becomes emphysematous. In pneumonia some of the air vesicles are blocked up by inflammatory or exudation products. During inspiration the chest dilates, but the air cannot enter the diseased air-cells; the surrounding alveoli therefore compensatorily dilate or become distended, and thus vicarious emphysema results. Very often the interlobular tissue is ruptured. Similarly in cases of protracted catarrhal affections of the smaller bronchi, the bronchial mucous membrane is thick and clogged with mucus, the air cannot enter the corresponding alveoli, the alveolar walls gradually waste, they become thinner and atrophy. Perforation results, ending in coalescence of several vesicles into one large cyst. Other parts of the lung free from catarrh now become vicariously emphysematous. In some cases of phthisis, when the progress is slow, the pleural walls near the apices of the lungs are adherent, the air-cells near the upper part of the chest cannot move during inspiration; those placed at the more moveable parts, as the base and anterior portions of the lung, therefore compensatorily expand and become distended. Emphysema of the lung is a very common affection, and is frequently seen associated in various degrees of intensity with old bronchial catarrhs and other affections in which obstinate cough is a marked symptom. It is rare in childhood, except in the form of those enlargements of the alveoli which occur as a result of whooping cough, especially in scrofulous and rachitic children, or accompanied by atelectasis of the posterior parts of the lung. Its frequency becomes great in those periods of life in which chronic bronchial catarrhs are most common. The majority of the sufferers belong to the male sex. The predisposition to emphysema is sometimes congenital.

Pathology.—The normal respiration consists in the power of contracting as in that of filling the chest. In emphysema the power of contracting the chest is lost. The lungs have lost their elasticity (reserved), and they therefore cannot contract in a perfect manner at the end of expiration. The walls of the chest and the diaphragm only recoil to their position of repose instead of being drawn inwards by the action of the muscles. In emphysema the thorax is kept abnormally distended and undergoes little enlargement at each inspiration, which act is rapidly accomplished as there is no obstacle to the passage of air. Expiration, on the other hand, is slow and laboured, because the lung-tissue has lost much of its elasticity and contracts very slowly after distension.

Results of emphysema.—There is loss of elasticity of the lung, and obliteration and lengthening of the pulmonary vessels, due to want of proper blood supply. These destructive changes may be due to primary atrophic changes in the capillaries extending to the larger vessels, or to the secondary atrophic changes after the vessels become lengthened, and the narrowing of the blood current follows as a result. The lungs are enlarged; they no longer exercise any traction upon the mediastinum, and the return of blood to the heart takes place slowly. The lungs remaining inflated as during deep inspiration, the results are enlarged thorax, flattened diaphragm, and displacement of the heart. In cases of hereditary emphysema, the atrophic changes are most marked. In acute cases the impairment is due to repeated over-distension of the air-cells during paroxysms of coughing. In chronic and hereditary cases the atrophic changes are due to fatty degeneration of the epithelium and vessels of the lung. In cases succeeding recurrent catarrh the repeated and long-continued congestion leads to imperfect development of fibro-cellular tissue, the lung substance becomes tough and degenerated. In emphysema, owing to impediment to the circulation of blood in the lung, the venous system is engorged with blood. The right heart is compensatorily dilated and thickened. During recurrent bronchitis or asthma there is fresh impediment to the pulmonary circulation, which leads to engorgement of the liver and portal system. In far-advanced cases the supply of blood to the left heart is very much diminished.

Morbid appearances.—In the general variety the chest is rounded. When the sternum is removed the lungs are incompletely retracted, or even seem bursting out of the chest, and the left lung sometimes completely covers the pericardium. The lungs, when removed, are soft to the touch and feel as if they had lost substance. The air-vesicles are seen to be enlarged, and the pulmonary vascular system is lengthened. The tissue is dry. The lungs are more inflated or expanded and are larger than the healthy lungs. Their elasticity is relaxed and their texture impaired. If the emphysema be extreme the lungs present, in section, large hollow spaces in the central infundibular cavities, traversed by thin bands, and the septa of the alveoli are shrivelled and atrophied. In local emphysema small circumscribed patches of highly dilated and tender vesicles [illegible]

[illegible]

[illegible] tissue. The [illegible] expanded, and appear on the [illegible] intersecting each other. If [illegible] near the root of the lung it escapes into the mediastinum, and thence into the areolar tissue of the neighbouring parts of the neck, &c. It may extend beneath the skin over the whole body.

Symptoms. — It is not till emphysema is considerably advanced that the symptoms become prominent. Limited emphysema is not capable of being recognised during life. The symptoms are the [illegible] They are the effects of enlargement of the [illegible] of [illegible]

[illegible]

attack of winter cough; the patient complains of shortness of breath and cough attended with frothy and viscid expectoration and a sense of constriction about the chest. The breathing is forced, and there is dyspnœa owing to the lung and thorax not expanding and contracting as they ought during normal respiration. Dyspnœa, increased on exertion, is temporary at first, but ultimately becomes permanent. It is often relieved by pressing the lower part of the sides or by lying upon the abdomen, and thereby compressing the thorax. It becomes worse after a meal, and hence such patients ought not to take heavy meals, especially before going to bed. It also increases with a fresh attack of bronchitis or of asthma. When the emphysematous condition is pronounced the aspect of the patient is characteristic; the breathing is forced, so that the alæ nasi dilate, the inspiratory muscles of the chest and those of the neck become harder from forced efforts at contraction. The imperfect oxygenation gives rise to drowsiness or apathy. The patients are generally flabby. During an attack of bronchitis supervening on the disease the patients sit propped up in bed, without much rest at night or during the day, and feel an alarming sensation of choking. The dyspnœa is extreme; the countenance appears very haggard, the face muddy and exhausted, the eyes fatigued, and the apathy increases. The circulation is feeble and the limbs are cold. After repeated attacks another set of symptoms appears. Owing to progressive degeneration of the pulmonary vessels and to imperfect aëration, as occurs during bronchitis, asthma, or collapse, the right side of the heart becomes hypertrophied, dilated, and distended compensatorily. The circulation becomes embarrassed; there is hyperæmia of the vessels of the bronchi and œdema of the lung. After a time there is fatty degeneration of the walls of the heart, and there are symptoms of engorgement of the superficial tributaries of the venæ cavæ; the jugular veins become distended. The patient is in a marked condition of cyanosis, more so than in cases of valvular disease of the left ventricle. The lips become blue, and the cheeks and nose present a prominent network of venous capillaries. The cervical veins also become distended, and the patient complains of giddiness, faintness, and headache. All these symptoms increase with a bronchitic cough. Other systemic veins are distended; venous hæmorrhages occur, and there is gastric and intestinal catarrh. The circulation is impeded in the extremities, and the blood being also poor in albumen, anasarca of the legs appears; congestion of the liver and of the kidneys results, with albuminuria. The obstruction also affects the thoracic duct, there is an obstruction to the flow of lymph and chyle, and the blood is, therefore, poor in fibrin. The flow of chyle being also less, the general nutrition is interfered with, and the patient emaciates. The respirations are slow and forced, the temperature normal. The left heart receives very little blood, and there is usually feebleness of the pulse, which is seldom above 90. The face is pale; the urine scanty, thick, of a dark colour, and full of urates; other symptoms are due to complications, as cough. The cough is a symptom of the bronchitis, and sometimes disappears during fine warm weather and when proper treatment is adopted. The disease is incurable, and, as age advances, the symptoms generally become more marked and more troublesome. Death may be caused by exhaustion or general dropsy. Much may be done by proper treatment to prolong life and to ward off complications.

Physical signs.—When emphysema is slight or limited, as sometimes occurs in cases of tubercles in the lung and in old age, there are no distinct physical signs to indicate its presence. In cases of chronic bronchitis vesicular emphysema may be suspected if bronchitis persist for some time. *Inspection.*—Abdomen is somewhat distended. In well-established cases the physical signs indicate alterations in the shape of the chest and in its movements. When emphysema is due to forced inspiration the chest is greatly and rigidly dilated in all directions and especially in the lower portion. It is barrel-shaped when forced expiration with narrowed glottis is its cause. This occurs in cases of violent and protracted cough and in persons engaged in loud singing or playing on wind instruments. In the latter condition the enlargement of the thorax is confined chiefly to the upper and middle portions. In old age there may be emphysema, but the chest is not dilated or barrel-shaped, owing to the fact that the cartilages have become ossified. A long loose chest may not exhibit signs of emphysema, although in this condition of the chest emphysema is very apt to occur. The deformity is not always due to emphysema, inasmuch as it and the emphysema are sometimes the result of the same cause. The cause of the barrel-shaped chest is obvious. During forced expiration the diaphragm is pushed upwards and the air in the lung is very much compressed. The elastic chest-walls, owing to the pressure from within being increased, become rounded and would remain spherical, but as the lower part of the thorax is fixed, it cannot expand so much as the upper and middle parts. The costal cartilages are deformed, elongated, and also firm and rigid. The upper ribs are crooked and bulged outwards. The sternum has lost its depression and is pushed forwards. The intercostal spaces above the nipple-line are somewhat depressed during inspiration, and on a level with the ribs on expiration. Below the nipple-level the depression is greater during inspiration, and the muscles are either on a level with the ribs during expiration or slightly puffed outwards. The direction of the ribs is more horizontal than in health. The shoulders are elevated, and the respiratory muscles of the neck and shoulders appear very prominent. With violent cough a swelling may appear in the upper part of the neck jutting out from the apex of the lung. The intercostal spaces are wider than normal, and the cartilages quite rigid. The respiratory movements are chiefly thoracic. The superficial veins are enlarged. The expansive movements are absent or deficient. During expiration the chest remains barrel-shaped, and during inspiration it enlarges somewhat. Impulse of the heart is feeble, and may be seen at the ensiform cartilage.

Palpation.—In advanced cases we find beating of the heart in the epigastrium synchronous with the pulse. This epigastric pulsation is due to hypertrophy of the right heart. There is no bruit. The liver is depressed.

Percussion.—In extensive emphysema the vital capacity of the lung is increased. There is increase of resonance or heightened natural clearness. The sound is never tympanitic, as some tension of the alveolar walls still remains. This resonance often invades the normal area of dulness of the heart and of the liver. In very aggravated cases diminution of resistance is sometimes observed on percussion.

Auscultation.—The sounds are due both to emphysema and to the accompanying catarrh. The breath sounds are weak and very indistinctly heard. This kind of respiratory murmur has been called *indeterminate*. The expiration is prolonged. Occasionally subcrepitant râles only are heard if bronchitis is also present. These are heard at the bases chiefly during inspiration. In a majority of cases some loose crepitant râles are permanently heard, with feeble respiratory murmur. In pure cases of emphysema uncomplicated with bronchitis we hear loud and harsh respiration. The heart sounds are feebly audible in their natural place, the heart being covered and displaced, but the sounds are distinct and even loud at the epigastrium.

Diagnosis.—The vicarious emphysema can be distinguished from the substantive by features peculiar to both. In the vicarious form, the anterior and lower part of the lung being mainly affected, there is generally the history of some primary pneumonia or pleurisy to account for it, or the dyspnœa has preceded the cough.

In the substantive variety there is history of violent cough, such as whooping-cough, or the patient perhaps has been in the habit of playing on wind-instruments, and presents a barrel-shaped chest. The dyspnœa comes on after the cough. The condition of chest

may simulate that of pneumothorax. In emphysema both sides are enlarged, but in pneumothorax the affection is limited to one side; besides, in pneumothorax percussion is more tympanitic, and during auscultation there is an amphoric murmur. If one part of the chest in pneumothorax be percussed while the ear is applied to another part the amphoric echo is heard. Emphysema is often associated with asthma, bronchitis, or affections of the heart. No such complications exist in pneumothorax.

Prognosis.—Once the disease is thoroughly established it cannot be eradicated; it increases the tendency to recurrent bronchitis. Emphysema protects the patient to some extent from tuberculosis, owing to the bloodless condition of the apices of the lungs in the former disease. Emphysematous patients in comfortable circumstances may live a long time. Bronchial catarrh, bronchiectasis, fatty degeneration of the right side of the heart, are the most serious complications. Slight degrees of emphysema can scarcely be said to influence unfavorably the duration of life.

Treatment. — Attempts must be made to prevent or cure or relieve the bronchial catarrh, or the whooping-cough which is associated with it, also to prevent its recurrence and to relieve cough and dyspnœa. In these cases there is increased venous congestion; the systemic venous capillaries are congested. The patients should be confined to their houses in winter. The bronchial catarrh may be relieved by suitable treatment. All known causes of emphysema must be avoided. Owing to obstruction to the venous system, the liver, stomach, and intestines are congested. The liver is first deranged. Attention must be paid to the condition of the alimentary canal. The bowels should be freely acted upon once every day. There is also a disposition to hæmorrhoids. Relief to the lung symptoms may be obtained by strict diet, rest, warm flannel clothing next the skin, &c. The secondary affections, as asthma, cardiac diseases, portal congestion, need cautious treatment. The state of the general health should be improved in every possible way. Various remedies, as stramonium, musk, and camphor, have been used as cigarettes, but they give only temporary relief. A course of iodide of potassium is often beneficial. A change of air is exceedingly useful, but the climate must be mild and not too dry. In emphysema, expiration is at fault and the lung texture relaxed. The compressed air or the concentrated air, rich in oxygen, breathed from an air chamber, leads to forcible expansion of the already over-expanded or the diseased lung, and is therefore injurious. It also renders the lungs more anæmic, and they are already defectively supplied with blood. Another disadvantage of the compressed air as a remedy in emphysema is the increased

pressure upon the vessels, and it thus impedes the action of the heart.

The rarefied air or a residence in some elevated spot would seem at first sight to be equally injurious, as the patient has to breathe more and more deeply to obtain the requisite quantity of oxygen. But it must be remembered that we use comparatively little of oxygen for our respiratory purposes, as the expired air is by no means deprived of this constituent. The air being rarefied the oxygenation is much quickened. The circulation also in a high altitude is carried on under less pressure, and hence the heart finds relief. As the altered condition of the heart leads to all other symptoms, if the power and nutrition of that organ can be maintained the life will be prolonged. During the interval, digitalis will be useful to give tone to the heart. It is necessary for the patient to take steady and moderate walking exercise without exciting the respirations. During any attack of intercurrent bronchitis, absolute rest to the parts is imperative. Dropsy, which occurs at an advanced period, may be relieved by the use of diaphoretics and diuretics, as squills and digitalis. Digitalis has the advantage of acting upon the kidneys and should therefore be freely given with expectorants or with bitter tonics. The portal system must also be relieved by mercurial aperients. In all cases of emphysema every endeavour should be made to prevent attacks of bronchial catarrh. The diet should be light, nutritious, and easy of digestion. Emetics are serviceable in severe attacks of dyspnœa. Stimulants are also indicated.

HYPERTROPHY OF THE LUNGS.

This condition is not due to a morbid process. It consists of enlargement, with increased functional activity, owing to the organ being called upon to do extra work. It is met with where one lung, or a portion of one lung, is lost by disease. The process is purely of a mechanical nature. When a portion of a lung is diseased, collapsed, or removed by some destructive cause the diseased portion cannot attain its normal volume in the chest during inspiration, the softer parts of the chest-wall on the affected side become retracted, and compensatory hypertrophy takes place in the healthy lung. The hypertrophy is known by gradual changes which occur in the healthy lung. These changes consist in increased functional activity, and an increased afflux of blood to the part.

Causes.—These are numerous. 1. Injury to some other portion of the same or of the opposite lung. 2. Compression of the oppo-

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Causes.—These are numerous. 1. Injury to some other portion of the same or of the opposite lung. 2. Compression of the oppo-

site lung by effusion (pleuritic or otherwise). 3. Diseases of a portion of one lung, as cirrhosis, chronic pneumonia, arrested phthisical condition of a portion of one lung. The rarefied air of mountainous regions exercises a very favorable influence upon the development of hypertrophy.

Post-mortem appearances. — Compensatory hypertrophy is different from hypertrophous emphysema, and from indurative hypertrophy due to heart disease. Hypertrophy is generally one-sided. A hypertrophied lung is larger and heavier than a normal lung. Its anterior border and the inferior margin are thick and rounded, and extend far beyond their normal limits. The lung tissue is firmer in texture and more resilient than in health. The capillaries are numerous and freely supplied with blood. In hypertrophous emphysema the alveolar walls are thinned and there is an excessive growth of fibrous tissue. The lung tissue, moreover, is comparatively bloodless. In induration of the lung, the capillaries are found to be dilated and tortuous.

Symptoms.—The respiration is puerile or exaggerated and there is prolonged expiration. The symptoms are those due to the predominant disease. There is more or less dyspnœa, and the action of the heart is interfered with.

Physical signs.—*Inspection.*—The chest is expanded on the hypertrophied side, the diseased portion or the opposite being flattened and contracted. *Percussion.*—The resonance is increased in area and may extend beyond the median line and also downwards and laterally. *Auscultation.* The respiratory murmur is puerile. The heart is displaced towards the contracted side. In hypertrophy of the left lung the displacement of the heart is considerable.

Diagnosis.—Hypertrophy of the lung may be mistaken for emphysema. In hypertrophous emphysema, the respiration is peculiar, there is a short, weak, and inaudible inspiration followed by wheezy prolonged expiration. In compensatory hypertrophy the breathing is puerile. Compensatory hypertrophy is generally unilateral; there is destruction or disease of the opposite lung; there is no history of bronchitis or asthma to account for its occurrence. As the hypertrophy becomes developed the health of the patient begins to improve.

Prognosis.—Is generally favorable, the development of hypertrophy constituting a favorable symptom.

Treatment.—Hypertrophy is a healthy condition and should therefore be encouraged. This condition is found when all the active symptoms have subsided. The patients should be removed to a bracing climate and abundance of fresh air allowed. All sources which might give rise to catarrh must be avoided. A sema in a few cases. It is also applicable in cases of *vicarious* emphysema In chronic pneumonia affecting one lung the diseased lung is occluded from the action of the air; the other lung becomes compensatorily dilated and emphysematous. Similarly in bronchitis certain air tubes become occluded by mucus, and the inspiratory force is occupied in distending the remaining portion, till the deficiency in the air spaces is compensated.

(*b*) *Forced expiration.*—The expiratory theory is best adapted to explain the origin of substantive emphysema. In cases of violent cough and as a result of loud singing or lifting heavy weights, the thorax is contracted and the glottis is narrowed. The escape of air through the narrowed glottis is impeded, and the air therefore remains in a compressed state, and is driven back in the upper bronchi, or to those portions of the lung which are least supported, as the apices, the anterior margins, and the parts corresponding to the intercostal spaces. In these parts of the lung the compressed air presses upon the air-cells, and they therefore dilate, become distended, and emphysematous.

(*c*) *The rigid enlargement of the chest walls.*—This mode of origin is rare. With it there is generally associated some nutritive changes to account for the distension, wasting, and perforation of the air-cells. In nearly all cases the nutritive changes and the rigid enlargement arise from the same causes. In rigid enlargement of the chest walls there is failure of nutrition or degeneration of the elastic ribs and cartilages, and the enlargement is permanent. This condition, then, causes the enclosed lung to expand and become emphysematous.

(*d*) The *failure of nutrition* damages the lung texture, the elasticity is impaired, and the air vesicles are relaxed. The elasticity of the chest walls tends to expand the chest, and the relaxed lung yields to the traction of the chest wall and the weight of the abdominal organs, and becomes emphysematous.

Varieties.—These are mainly two. Local, secondary, or vicarious, and general, primary, or substantive emphysema. Other modifications may be met with. These are—1. Hypertrophous or large-lunged emphysema. In it the air-cells are dilated, and the condition is associated with great increase in the bulk or capacity of the lungs. It is due to frequent attacks of bronchitis, which diminish the elasticity of the tissue. 2. Atrophous emphysema, as occurs in old people, where the walls of the air-cells are wasted from interstitial decay, and have not the elasticity to dilate. 3. Interlobular emphysema. This occurs as a result of accident or from rupture of air-cells near the surface and interlobular interstices, with consequent escape of air into the subpleural and interstitial conneclocal atrophy the symptoms are those due to the predominant disease. In partial atrophy, which occurs in hypertrophous emphysema, the pulmonary capillary vessels are extensively obliterated, a sort of mechanical congestion is set up, and the symptoms are those of congestion of the whole venous system. The impaired elasticity seriously affects the mechanism of the lung, and the function of respiration is much prejudiced by the atrophy of the alveoli.

Physical signs.—Size of the chest. The capacity is diminished in all directions in senile atrophy. The lower ribs are approximated and their obliquity is increased. The upper intercostal spaces are depressed. The movements are limited.

Percussion.—The resonance is increased all over except over the præcordial region. *Auscultation.*—The respiratory sounds are weak but not otherwise altered. The patients are sometimes cyanotic, because the right side of the heart is imperfectly emptied, owing to the obliteration of so many capillary vessels in the lungs. Bronchitis is a chief complication, and when it supervenes death almost always occurs.

Patients the subjects of pulmonary atrophy may live for a long time if any source of bronchitic mischief be avoided.

Treatment.—This consists in warding off complications and in promoting the nutrition and comfort of the patient.

ANÆMIA OF THE LUNG.

This condition arises whenever there is a deficiency of blood in the lungs. Like atrophy anæmia may be general or circumscribed. The disease is characterised by gasping and restlessness as seen in cases of fatal hæmorrhage.

Causes.—General anæmia of the lung is due to causes which give rise to bloodlessness generally. In senile atrophy and in vesicular emphysema of the lung, the lung capillaries are destroyed and anæmia results. Partial anæmia of the lung occurs in cases of obstruction (embolism) to the branches of the pulmonary artery. Pressure of a malignant growth or of an aneurism may obstruct the trunk or a branch of the pulmonary artery, and lead to anæmia of the portion to which the blood is distributed.

Post mortem appearances.—The tissue of the lung is exceedingly pale. The mucous membrane of the bronchi is also blanched from want of blood. The lungs are lighter in weight. Sometimes the lungs are slightly œdematous.

Symptoms.—In anæmia due to embolism, death and sloughing of the lung are the consequences. The sudden arrest of circulation through a portion of the lung embarrasses the collateral circulation thorax is kept abnormally distended and undergoes little enlargement at each inspiration, which act is rapidly accomplished as there is no obstacle to the passage of air. Expiration, on the other hand, is slow and laboured, because the lung-tissue has lost much of its elasticity and contracts very slowly after distension.

Results of emphysema.—There is loss of elasticity of the lung, and obliteration and lengthening of the pulmonary vessels, due to want of proper blood supply. These destructive changes may be due to primary atrophic changes in the capillaries extending to the larger vessels, or to the secondary atrophic changes after the vessels become lengthened, and the narrowing of the blood current follows as a result. The lungs are enlarged; they no longer exercise any traction upon the mediastinum, and the return of blood to the heart takes place slowly. The lungs remaining inflated as during deep inspiration, the results are enlarged thorax, flattened diaphragm, and displacement of the heart. In cases of hereditary emphysema, the atrophic changes are most marked. In acute cases the impairment is due to repeated over-distension of the air-cells during paroxysms of coughing. In chronic and hereditary cases the atrophic changes are due to fatty degeneration of the epithelium and vessels of the lung. In cases succeeding recurrent catarrhs the repeated and long-continued congestion leads to imperfect development of fibro-cellular tissue, the lung substance becomes tough and degenerated. In emphysema, owing to impediment to the circulation of blood in the lung, the venous system is engorged with blood. The right heart is compensatorily dilated and thickened. During recurrent bronchitis or asthma there is fresh impediment to the pulmonary circulation, which leads to engorgement of the liver and portal system. In far-advanced cases the supply of blood to the left heart is very much diminished.

Morbid appearances.—In the general variety the chest is rounded. When the sternum is removed the lungs are incompletely retracted, or even seem bursting out of the chest, and the left lung sometimes completely covers the pericardium. The lungs, when removed, are soft to the touch and feel as if they had lost substance. The air-vesicles are seen to be enlarged, and the pulmonary vascular system is lengthened. The tissue is dry. The lungs are more inflated or expanded and are larger than the healthy lungs. Their elasticity is relaxed and their texture impaired. If the emphysema be extreme the lungs present, on section, huge hollow spaces in the central infundibular cavities, traversed by thin bands, and the septa of the alveoli are shrivelled and atrophied. In local emphysema small circumscribed patches of highly-dilated and tender vesicles, traversed may result from chronic pneumonia, phthisis, or cancer, or morbid growths in the lung tissue; from the pressure of pleuritic effusion or of enlarged bronchial glands, or of thoracic tumour upon the lungs. The softness and weakness of the ribs, as in rickets, are the most frequent cause of collapse.

Post-mortem appearances.—The collapse may be diffuse or limited to a few vesicles. In the diffuse form the whole lung or a number of lobules are affected, and they give a solid appearance to the diseased portion. In the other variety the diseased part forms a hardened patch or tumour upon the surface or in the interior of the lung. The collapsed lung is of the consistence of liver; it is much reduced in bulk, wrinkled, of a dark violet colour, and engorged with blood; may be somewhat thickened and non-crepitating, or very dense. It resists pressure and sinks in water with rapidity. When cut into the surface is smooth, uniform, and flesh-like. On pressure or scraping it bloody serum escapes. On inflation the collapsed portion assumes a natural appearance, which shows that the lung tissue is intact. Congestion of the lung is a constant accompaniment of collapse, and is connected with bronchitis in a few cases. The most common seats of collapse are the lower margins of the left lower lobe.

Symptoms.—These vary with the cause, and also with the extent and intensity of collapse. In severe cases, as seen in children, bronchitis or pneumonia is concomitant with collapse, symptoms of which show themselves only a short time before death. There is great prostration, restlessness, and sleeplessness. The temperature falls, the surface of the skin becomes pale and bluish. The skin is generally cold; the eyes are shrunken; the pulse is very small, frequent, and feeble. The child has a feeble cry. There is a sudden appearance of rapid and oppressed breathing. There is a long pause between inspiration and expiration, instead of after expiration. There is no pain in the chest as in pleurisy. The cough is constant but ineffectual, not so suffocative as in bronchitis.

Physical signs.—*Inspection.*—The lower part of the chest is retracted and diminished in size, the intercostal spaces sink during inspiration, and move outwards during expiration. *Percussion.*—There is dulness over different parts of the chest. *Auscultation.*—A feeble or suppressed respiratory murmur is heard over the affected parts. Imperfect bronchial respiration and rhonchi are generally heard all over the chest. Other signs are those of bronchitis.

Diagnosis.—Collapse of the lung may be mistaken for atelectasis pulmonum or congenital collapse. In atelectasis the lung retains its fœtal condition, the respiration not being established. In apneuattack of winter cough; the patient complains of shortness of breath and cough attended with frothy and viscid expectoration and a sense of constriction about the chest. The breathing is forced, and there is dyspnœa owing to the lung and thorax not expanding and contracting as they ought during normal respiration. Dyspnœa, increased on exertion, is temporary at first, but ultimately becomes permanent. It is often relieved by pressing the lower part of the sides or by lying upon the abdomen, and thereby compressing the thorax. It becomes worse after a meal, and hence such patients ought not to take heavy meals, especially before going to bed. It also increases with a fresh attack of bronchitis or of asthma. When the emphysematous condition is pronounced the aspect of the patient is characteristic; the breathing is forced, so that the alæ nasi dilate, the inspiratory muscles of the chest and those of the neck become harder from forced efforts at contraction. The imperfect oxygenation gives rise to drowsiness or apathy. The patients are generally flabby. During an attack of bronchitis supervening on the disease the patients sit propped up in bed, without much rest at night or during the day, and feel an alarming sensation of choking. The dyspnœa is extreme; the countenance appears very haggard, the face muddy and exhausted, the eyes fatigued, and the apathy increases. The circulation is feeble and the limbs are cold. After repeated attacks another set of symptoms appears. Owing to progressive degeneration of the pulmonary vessels and to imperfect aëration, as occurs during bronchitis, asthma, or collapse, the right side of the heart becomes hypertrophied, dilated, and distended compensatorily. The circulation becomes embarrassed; there is hyperæmia of the vessels of the bronchi and œdema of the lung. After a time there is fatty degeneration of the walls of the heart, and there are symptoms of engorgement of the superficial tributaries of the venæ cavæ; the jugular veins become distended. The patient is in a marked condition of cyanosis, more so than in cases of valvular disease of the left ventricle. The lips become blue, and the cheeks and nose present a prominent network of venous capillaries. The cervical veins also become distended, and the patient complains of giddiness, faintness, and headache. All these symptoms increase with a bronchitic cough. Other systemic veins are distended; venous hæmorrhages occur, and there is gastric and intestinal catarrh. The circulation is impeded in the extremities, and the blood being also poor in albumen, anasarca of the legs appears; congestion of the liver and of the kidneys results, with albuminuria. The obstruction also affects the thoracic duct, there is an obstruction to the flow of lymph and chyle, and the blood is, therefore, poor in fibrin. The flow of chyle being also less, the general nutrition is interfered

DISEASES OF THE PLEURA.

INFLAMMATION OF THE PLEURA—PLEURITIS—PLEURISY.

PLEURISY is an inflammation of the pleura or of the membrane covering the lungs, and it occurs in two main forms. In the first the inflammation leads to proliferation of the connective tissue, ending in thickening of the pleura and adhesion of its opposed surfaces, without any effusion of serum within its cavity. In the second form there is thickening and also effusion, containing fibrin and young epithelial cells within the sac.

Causes.—Pleurisy varies in degree, in extent, and duration. It may occur as an independent disease or as a complication, as in croupous pneumonia and in phthisis. It affects persons of all ages. A sudden chill may cause it, but more often its cause is unknown or obscure. Injury of the pleura, as in fracture of the ribs; irritation of the pleura from the deposit of cancer or tubercles in it; or the introduction into the pleural cavity of pus or blood, either from pulmonary cavities or otherwise, leads to pleuritis with effusion of serum and fibrin into the sac. The extension of inflammation from the lungs or other neighbouring parts is a fertile source of pleuritis. In such cases the pleurisy is attended with very scanty exudation at first, and subsequently the effused product becomes copious and sero-fibrinous. As a complication it is most common in Bright's disease, pyæmia, rheumatism, and acute specific fevers. It attacks more frequently the weak and the debilitated than the strong and robust. In the former class the predisposition for all kinds of inflammatory diseases is very great, and more especially for inflammation of the serous membranes. In pyæmia and other infectious diseases the prevalence of pleurisy is due to the absorption of the poison into the blood and its conveyence to the pleura, as to the other serous membranes.

Morbid appearances.—It is an inflammation of the serous membrane investing the lungs and lining the cavity of the thorax, and, like inflammations of other serous membranes, it is characterised at first by increased vascularity and redness in points or stripes, also by small ecchymotic spots upon the surface of the pleura, due to slight extravasations of blood. The membrane is dry at first, but soon becomes moist, darker, softer, and clouded. The surface, being deprived of its epithelium, has lost its smooth appearance, and looks dull. It subsequently becomes shaggy-looking, owing to the development of minute delicate folds and papillary granulations, which are firmly attached to the surface. Under the microscope these granulations consist of newly-formed fusiform cells and filaments of connective tissue, with elongated capillaries coiled into loops within them. These changes occur in every kind, whether there be effusion or not.

Varieties.—These are four. The commonest forms of pleurisy are: *first*, that in which there is no free exudation; *second*, pleurisy with scanty but very fibrinous exudation; *third*, pleurisy with abundant sero-fibrinous exudation; *fourth*, pleurisy with purulent effusion (empyema). In the first there are alterations in the tissues of the pleura generally on both surfaces, but they are not very extensive. The pleuræ are thick, and there is adhesion of the opposing surfaces. The second variety is most common. It is often met with in cases of pneumonia and of other chronic lung diseases. It may, however, exist as an independent disease. The other alterations besides those common to the first kind take place, and the surface becomes coated by a delicate membranous coagulum of fibrin and young cells. The deposit when profuse appears like a croupous membrane. It is white in colour, soft, and about half a line in thickness. In cases of recovery the fibrinous deposit either undergoes fatty degeneration and liquefaction, and is ultimately absorbed, or adhesions take place between the pulmonary and costal pleura by the organization of the deposit into fibrous tissue.

In the third variety the alterations in the tissues of the pleura are very extensive. The costal as well as the pleural surface presents several changes. The sac also contains serum, varying in quantity from two to ten pounds. The exudation consists of a clear yellowish-green fluid and a quantity of coagulated fibrinous masses. The fibrinous coagula may partly float in the serum as flakes and lumps, and partly may traverse it as a loose network; or some portion may be precipitated on the pleura as a membrane. The longer the effusion remains the more rigid the masses of fibrin become, and they are finally converted into fibrous bands. A few pus-corpuscles are also found, both in the serum and in the fibrinous deposit. This appearance shows that this form, if not timely checked, may run on to empyema. The proportion between serum and fibrin varies. Sometimes in chronic or long-standing cases, owing to the rupture of the very delicate walls of the capillaries, there is a little blood. Very often soft adhesions surround the effusion, and portions of it thus become encapsulated. Other changes are to be noticed as taking place in the thorax and within the chest. The thorax is dilated, the intercostal spaces are widened and prominent, the diaphragm is forced down into the abdomen, and the mediastinum and heart displac from their original seat. The lungs are compressed, and even pus may result from chronic pneumonia, phthisis, or cancer, or morbid growths in the lung tissue; from the pressure of pleuritic effusion or of enlarged bronchial glands, or of thoracic tumour upon the lungs. The softness and weakness of the ribs, as in rickets, are the most frequent cause of collapse.

Post-mortem appearances.—The collapse may be diffuse or limited to a few vesicles. In the diffuse form the whole lung or a number of lobules are affected, and they give a solid appearance to the diseased portion. In the other variety the diseased part forms a hardened patch or tumour upon the surface or in the interior of the lung. The collapsed lung is of the consistence of liver; it is much reduced in bulk, wrinkled, of a dark violet colour, and engorged with blood; may be somewhat thickened and non-crepitating, or very dense. It resists pressure and sinks in water with rapidity. When cut into the surface is smooth, uniform, and fleshlike. On pressure or scraping it bloody serum escapes. On inflation the collapsed portion assumes a natural appearance, which shows that the lung tissue is intact. Congestion of the lung is a constant accompaniment of collapse, and is connected with bronchitis in a few cases. The most common seats of collapse are the lower margins of the left lower lobe.

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Diagnosis.—Collapse of the lung may be mistaken for atelectasis pulmonum or congenital collapse. In atelectasis the lung retains its fœtal condition, the respiration not being established. In apneumatosis the lung, once permeable, ceases to admit air. Apneumatosis may be mistaken for croupous pneumonia. The latter is rare in infants. There is absence of high temperature and other symptoms pertaining to pneumonia in apneumatosis. In pleuritic effusion there is more decided dulness on percussion.

Prognosis.—In children recovery attends on careful management and hygiene, provided that the general health be fairly good. If the child is weak the risk to life is very great. The danger depends upon the amount of bronchitis which accompanies the collapse of the lung, and on the state of the constitution. Death is sure to follow if apneumatosis supervenes upon atelectasis. In simple cases death is generally due to slow asphyxia. Death is rapid if the collapse follows acute bronchitis or severe whooping-cough.

Treatment.—The strength must be sustained, and the temperature of the room and the child's clothing carefully regulated. The diet should be nourishing and strengthening. Beef tea, port wine, or brandy are useful. In slight cases the daily use of a gentle emetic of carbonate of ammonia, combined with ipecacuanha, to remove the accumulation, has been found successful. Counter-irritation, as weak mustard plasters to the chest and extremities, or stimulating liniments of ammonia, turpentine, or amber, are successful aids. Where the patient is weak the cough and restlessness may be relieved by small doses of opium. If the lungs are extensively involved, and prostration has set in, the vital powers may be kept up by ammonia and brandy. For the associated bronchitis such measures are to be adopted as subdue the inflammation, diminish the amount of secretion, and relieve the congested lung of an excess of blood. For this purpose cupping, mustard foot baths, and counter-irritation are useful.

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In the third variety the alterations in the tissues of the pleura are very extensive. The costal as well as the pleural surface presents several changes. The sac also contains serum, varying in quantity from two to ten pounds. The exudation consists of a clear yellowish-green fluid and a quantity of coagulated fibrinous masses. The fibrinous coagula may partly float in the serum as flakes and lumps, and partly may traverse it as a loose network; or some portion may be precipitated on the pleura as a membrane. The longer the effusion remains the more rigid the masses of fibrin become, and they are finally converted into fibrous bands. A few pus-corpuscles are also found, both in the serum and in the fibrinous deposit. This appearance shows that this form, if not timely checked, may run on to empyema. The proportion between serum and fibrin varies. Sometimes in chronic or long-standing cases, owing to the rupture of the very delicate walls of the capillaries, there is a little blood. Very often soft adhesions surround the effusion, and portions of it thus become encapsulated. Other changes are to be noticed as taking place in the thorax and within the chest. The thorax is dilated, the intercostal spaces are widened and prominent, the diaphragm is forced down into the abdomen, and the mediastinum and heart displaced from their original seat. The lungs are compressed, and even pushed upwards. The lung on the unaffected side is the seat of intense collateral fluxion, and, in fatal cases, of collateral œdema. In cases of intense effusion the lung on the affected side is considerably reduced in size and flattened, and of a lead colour, and devoid of air and blood.

If recovery takes place the exudation gets thicker and undergoes fatty degeneration, or liquefies and becomes absorbed, and may thus disappear completely, but adhesions always remain. Sometimes cheesy masses, the remains of exudation, are found embedded between the adhesions. When absorption takes place early the lung may re-expand, and heart, diaphragm, &c., regain their normal position. In far-advanced or old-standing cases firm fibrinous adhesions or late absorptions prevent the re-expansion of the lung. A vacuum is formed, to fill up which constriction of the chest and displacement of the heart and liver take place. The fourth variety is *empyema*. In this the lung is too firmly bound down to admit of expansion, the vessels of the affected pleura are also distended, and the newly-formed capillaries delicate and yielding. The over-production of cells leads to suppuration. The liquid portion of the effusion is very rich in pus-corpuscles, and forms an opaque, yellow fluid. The fibrinous portion also contains pus-cells. In very healthy individuals this kind of exudation may become absorbed, but the general termination is that the pus-corpuscles invade the tissue of the pleura itself, which becomes opaque and softened, and irregular loss of substance occurs. If the costal layer be mainly affected external perforation may take place and recovery follow. If the pulmonary layer be perforated the pus may escape through a bronchus; but such cases generally end fatally.

Symptoms.—These vary with the kind, extent, position, and intensity and cause of the inflammation, and resemble those of inflammation of serous membranes generally; they also refer to inflammatory exudations, to other products pressing upon the neighbouring parts, and to the state of general health. The body is bent towards the affected side. There is inflammatory fever, hurried respiration, dyspnœa, and thoracic pain during breathing. The respiration is shallow, owing to the efforts of the patient to avoid tension of the inflamed pleura. There are also the physical signs. In some cases the symptoms are very insidious; there may be slight fever, loss of appetite, and pain on taking deep breath, or on twisting the body. The patient may follow his occupation, and after the lapse of a week or two the dyspnœa and pain may somewhat increase, and the implicated side may become distended with fluid. In other cases the principal symptom is severe pain in one side of the chest. The face looks anxious and expressive of distress.

In the *first variety*, the so-called "dry pleurisy," there are no marked symptoms. In the *second* there is severe piercing pain or a sharp stitch when the breath is drawn, and coughing and sneezing are especially painful, as these acts compress the pleura from within. External pressure also causes pain. The pain, which is due to the existence of exudation, is relieved if the patient lies on the sound side. There is generally cough; but its cause is doubtful. It may be of reflex origin. There is generally very little fever or other serious disturbances of health. This can be easily explained by the fact that there is very little exudation or mischief in the lung.

The third variety begins acutely, and is attended with severe local and constitutional symptoms. Their existence indicates marked pleurisy with sero-fibrinous exudation. The attack begins with a rigor, followed by intense fever and full and quick pulse. The vital capacity of the lung for air is considerably diminished, and is often as low as 70 or 80 cubic inches instead of 200, as in health. The temperature is about 103° or 104°. There is headache, occasional giddiness, and pain in the limbs, or all over the chest; there are often several rigors, preceded by sharp stitches; later on, as the effusion becomes complete, the pain may become less or cease altogether. There is great thirst. The tongue is coated white in the centre and red at the tip and edges. The urine is scanty, of a deep amber colour, and of acid reaction. The chlorides are diminished. There is distressing cough; and this may be owing to collateral hyperæmia. The expectoration is scanty, viscid, and muco-purulent. There is very often dyspnœa, and it may in part be caused by collateral hyperæmia and in part by pressure of the effusion upon the lung. When the fever abates the dyspnœa considerably subsides, even though the effusion may remain. This is owing to the diminished consumption or less need of oxygen. After the disease has continued very severe for six or eight days a sudden improvement may take place, which is followed by absorption and subsidence of fever and dyspnœa. The absorption takes place rapidly at first, and then, as the fluid becomes smaller in quantity, the process takes place slowly.

In this variety some cases, though acute at first, after a time become chronic. The fever moderates at the end of a week, but absorption does not take place. The effusion remains in the same condition for a long time, and when at last absorption begins fever reappears, and effusion again increases. General adynamic symptoms soon set in, and such cases often end fatally. Another variety of this class begins slowly and progresses tediously. There is no great fever, no pain. There is slight shortness of breath, followed by great prostration and debility, and these symptoms, associated with loss of flesh, demonstrate the existence of pleuritic effusion. In these cases there is a tendency to caseous degeneration and to tubercular disease. This kind often ends in phthisis. All forms of pleurisy may, however, end in recovery. Generally adhesions take place without causing any serious inconvenience. In some long-standing cases amyloid disease may be traced in the liver or kidneys.

The fourth form (empyema) can be distinguished from the others only by the long duration of the disease and the persistence of the high temperature. The temperature on the affected side is about a degree higher than on the sound side. The other symptoms are like those of the third variety; they are due to compression of the lung. There is great dyspnœa, the respirations are hurried, shallow, and abdominal. The pulse is very frequent, small, weak, and easily compressible. There is pain in the epigastric and umbilical regions. The tongue is furred, the appetite impaired; urine is scanty, high coloured, and of high specific gravity, sometimes contains albumen. The temperature averages about 103°. The vital capacity for air is reduced to a minimum. The sinking of the dulness line, as commonly occurs in empyema, is not a certain sign of diminution of effusion, for it may occur from the thoracic walls and intercostal muscles having become more yielding, or from the diaphragm having become relaxed and forced further downwards. Incomplete recovery takes place when the compressed lung cannot expand. The thorax collapses, and there is displacement of other organs.

In this form, if empyema points externally, an œdematous swelling of the skin appears on the wall of the chest, generally near the fourth or the fifth rib. A fluctuating tumour projects through the intercostal spaces, and discharge of pus follows; it rarely ends in recovery. Sometimes incomplete recovery takes place; sometimes a thoracic fistula results, and lasts for years. If empyema points into a bronchus a tremendous gush of pus occurs through the mouth. Perforation through the diaphragm is followed by violent peritonitis. Statistics have shown the rate of mortality to be one in four. Deaths from empyema of the right side are twice as frequent as when the effusion occurs on the left side.

A fatal result in recent pleurisy is usually caused by collateral hyperæmia. Death sometimes takes place from the intensity of fever or from tuberculosis. If the lung be much compressed the return of blood to the left auricle is interfered with, and the right ventricle and the venæ cavæ become engorged. If the heart be displaced to the right side the inferior vena cava is bent as it leaves the foramen in the diaphragm. The results of these changes may be albuminous urine, dropsy, cyanosis, &c. The causes of death in empyema are escape of the fluid into the lungs or peritoneum, chronic fever, tuberculosis, and pneumonia.

Physical signs.—Measurements.—When the effusion is scanty there is no marked difference between the two sides. When large effusion occurs the affected side of the chest measures about one inch more than the opposite side.

Inspection.—When the exudation is scanty the results are generally negative; but when the effusion of serum is large the physical signs are well marked. In the *first variety* we find the expansile movements diminished on the affected side. The intercostal spaces are not affected; the respirations are abnormal. In the *second*, when the effusion fills half of the chest, the whole side is dilated in all directions, but chiefly in the antero-posterior diameter. When the effusion is small in quantity it occupies the base of the pleural cavity behind, but does not alter the form of the chest. Where the effusion is circumscribed and encapsulated the dilatation is confined to the effused region, or there may be a local bulging corresponding to the mammary region. The expansile movements are almost absent. In the *third* variety, if the effusion be on the left side, the displacement of the heart may be made out by the impulse being very low and towards the median line; if on the right side there will be displacement of the liver. Besides these signs the thoracic wall does not move or dilate on respiration as far as the effusion reaches; this is partly owing to the infiltration and palsy of the intercostal muscles, and partly to non-expansion of the lung. The diaphragm may project into the abdomen, and, being not palsied, its contraction during every inspiration leads to sinking of the epigastrium. Sometimes after absorption the heart is still pushed out of place by adhesions. Where the lung does not expand the thorax may shrink, and there is reduction both in length and in the antero-posterior diameter. It is therefore necessary, in these cases, to use the cyrtometer from time to time, and where the lungs are not expanded after the exudation has become absorbed the heart may sometimes be seen to beat as far to the left as the axillary line. This is owing to the fact that the heart, which was before absorption pushed to the right, now, after absorption, is pushed to the left to fill up the vacuum caused by the disappearance of the fluid. It must be remembered that even after shrinking of the chest some effusion may remain.

Palpation.—The sensation of friction (pleural fremitus) is often perceptible in the first variety. In the second there is diminution or absence of friction fremitus where the effusion is in contact with the thoracic wall, and vocal vibration is diminished. When the two surfaces of the pleura have not become separated to a great extent by effusion, fremitus is felt chiefly in the infra-clavicular and the whole of the mammary region. Pleural fremitus is generally of a fine grating character, and consists of a quick succession of detached sensations. Sometimes the impression is that of scraping or scratching. Above the limit of the effusion the vocal fremitus is intensified, because the retracted pulmonary tissue is a better conductor than the unretracted. The abrupt transition from weak to increased fremitus marks the line of effusion. This is best marked in front and at sides; behind, the signs change more gradually. Palpation is also useful for ascertaining the position of the heart and liver.

Percussion.—In the early stage when the effusion is scanty it reveals nothing. In the second variety, where large effusion occurs, we find marked dulness over the affected side of the chest in all the regions anteriorly as well as posteriorly. In the third variety there is also dulness. The dulness is higher up behind than in front. The characteristic point about dulness is that it varies with the change of posture, except in cases where adhesions form rapidly. Over the space where the retracted lung touches the thoracic wall the percussion is tympanitic and hollow. The dulness becomes less perceptible on the back and below the scapula. As the fluid increases it reaches the front. It seldom extends so far upwards in front as behind. The axillary line is a common limit in front. Anteriorly the percussion varies very abruptly from tympanitic sounds to a complete dulness: posteriorly such a transition is not noticed owing to the effusion gradually diminishing from below upwards.

Auscultation.—In the early stage and in the first form, friction sounds are heard in the mammary region on inspiration and on expiration. These may be distinguished from rhonchi by the fact that the latter sound like the bursting of bubbles, and undergo various modifications on coughing. A friction sound is heard more distinctly when the stethoscope is pressed firmly against the chest. This is owing to the rubbing of the two rough surfaces of the pleura against one another with a certain degree of rapidity. It is rarely heard in the beginning, as the deposit is not rough enough, and also the patient breathes very slowly to avoid pain, and hence the surfaces do not rub against one another very quickly. It is most marked when the exudation is beginning to get absorbed or the fluid is removed by tapping. When the exudation is not very large, faint breath sounds (vesicular murmur) are audible over the region of dulness. There is ægophony owing to the thin layer of fluid intercepting some and transmitting other sonorous vibrations. This sound is most marked towards the upper margin of the fluid. When the effusion is large, neither vocal resonance nor breath sounds are heard owing to the pressure of the fluid upon the air-vesicles and the bronchial tubes. Between the scapula and the spine, faint bronchial respiration and bronchophony may be heard. This is owing to the fact that the compressed lung in these situations lies close to the thoracic wall, and also that when the cavity is full of fluid, the respiratory murmur is conducted for a short distance across the back or to the root of the lung, from the unaffected lung. Sometimes the lung does not collapse owing to adhesions, consolidation, or congestion. In such cases loud bronchial breathing is heard at the base although the effusion may be large. In the other or unaffected part of the chest, both on the healthy and diseased sides, the respiration is puerile or harsh. This is chiefly heard in the supra- and infra-clavicular region of the diseased side. Sometimes tubular breathing may be heard in the mammary region.

Terminations.—Convalescence may occur at any stage. Many patients recover before effusion takes place; the fever and pain subside and the friction sound vanishes. In many cases some amount of dyspnœa remains, and the patient after a time catches a fresh cold and has a relapse. In cases of effusion recovery also takes place after absorption of the fluid or its removal by operation. The lung then expands fairly, the breathing improves, the appetite grows better, and the condition of the body is recovered. As the fluid is absorbed, and for some time after the completion of the process, pain and friction sounds may be re-established, the lung enlarges again from its shrivelled condition, and the breath sounds are restored. It sometimes happens that the lung in some part remains collapsed, the remainder having fairly expanded. Death is rare in acute pleurisy; in cases of effusion it may happen suddenly from asphyxia, syncope, or asthenia. The fluid effusion may lead to pulmonary congestion and œdema of the lung on the unaffected side. In protracted cases pleuritis may pass into a suppurating form, leading to effusion of pus. Empyema or the purulent effusion may discharge itself either externally, or by the bronchi, or into the intestines. Retraction of the side, due to extensive adhesions and non-expansion of the lung, is another termination of pleuritis.

Diagnosis.—Slight pleuritic attacks are often overlooked. Cases of pleurisy with abundant effusion are not always easy to distinguish from pneumonia with infiltration. 1. Pleurisy rarely begins with a single violent chill. 2. The course of pleurisy is never the thoracic wall, and vocal vibration is diminished. When the two surfaces of the pleura have not become separated to a great extent by effusion, friction is felt chiefly in the infra-clavicular and the whole of the mammary region. Pleural fremitus is generally of a dull grating character, and consists of a quick succession of detached sensations. Sometimes the impression is that of scraping or scratching. Above the limit of the effusion the vocal fremitus is intensified, because the retracted pulmonary tissue is a better conductor than the unretracted. The abrupt transition from weak to increased fremitus marks the line of effusion. This is best marked in front and at sides; behind, the signs change more gradually. Palpation is also useful for ascertaining the position of the heart and liver.

Percussion.—In the early stage when the effusion is scanty it reveals nothing. In the second variety, where large effusion occurs, we find marked dulness over the affected side of the chest in all the regions anteriorly as well as posteriorly. In the third variety there is also dulness. The dulness is higher up behind than in front. The characteristic point about dulness is that it varies with the change of posture, except in cases where adhesions form rapidly. Over the space where the retracted lung touches the thoracic wall the percussion is tympanitic and hollow. The dulness becomes first perceptible on the back and below the scapula. As the fluid increases it reaches the front. It seldom extends so far upwards in front as behind. The axillary line is a common limit in front. Anteriorly the percussion varies very abruptly from tympanitic sounds to a complete dulness; posteriorly such a transition is not noticed owing to the effusion gradually diminishing from below upwards.

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cyclical. In pleurisy there is no sudden crisis when the improvement takes place. 3. In pleurisy the sputa are indicative of catarrh, or œdema, and always consist of sticky mucus, sometimes mixed with streaks of blood, but are never truly rusty. 4. In pleuritic effusion the chest is enlarged, the intercostal furrows widened, the heart and liver are not in their natural place. There is absence of vocal fremitus, and on percussion the dulness is absolute. There is either a feeble respiratory murmur, or none at all, or bronchial breathing is present. Pleuritic effusion on the right side often leads to displacement of the liver downwards, and this may be mistaken for enlargement of the organ. In both cases the liver may reach some distance below the margin of the ribs. In cases of effusion (1) the liver is pushed downwards, and there is dulness on percussion extending considerably higher than the normal line: the liver rarely pushes the diaphragm upwards; (2) in pleurisy the dulness is higher behind than in front: in enlarged liver the opposite condition holds; (3) when the liver is enlarged, its lower border, and with it the dulness, move downwards on inspiration and upwards on expiration, but in large pleuritic effusion the lower border of the liver is stationary; (4) in the enlarged liver the feeling of resistance presented by the thoracic wall on palpation is continuous. In the case of effusion a small yielding interspace is generally discoverable between the border of the ribs and the surface of the liver; (5) in enlargement of the liver the lower ribs are bowed outwards, but the intercostal spaces are not effaced, except in rare cases. The pleuritic effusion on the left side may be confounded with enlarged spleen. In the latter condition there is movement of the spleen upwards and downwards during expiration and inspiration. In chronic cases the persistence of fever and emaciation may awaken suspicion that phthisis is developing. A thorough examination of the chest will decide the question.

Prognosis.—If properly managed, cases of dry pleurisy, and those in which pleurisy is single and the effusion scanty, generally terminate favorably. The danger depends upon the nature of the primary disorder. Cases due to consumption or pneumonia are serious. In pleurisy with profuse effusion a rapid decrease of effusion is a favorable sign; the sooner absorption occurs the better. Cases with effusion are serious in proportion to the amount and rapidity of effusion; to the time the fluid remains in the pleura, and according to the nature of the fluid. Where the disease becomes chronic the danger is greater. The symptoms of œdema of the lung and imperfect decarbonization of the blood are unfavorable signs. Caries of a rib is usually followed by a lingering course and death. A prolonged empyema may also lead to general amyloid

disease or to tuberculosis or septicæmia and death. Scanty urine, which often occurs during empyema, is of a very unfavorable augury. Similarly, the existence of albumen in the urine, with casts and blood, and symptoms of cyanosis and dropsy due to congestion of the veins, are very dangerous.

Treatment.—In cases of pleurisy with effusion, the constitution of the patient considerably influences the success or otherwise of the treatment. Generally, however, the treatment consists in subduing the inflammation and promoting the removal of its products. In the early stage, the stitch is a most troublesome symptom. The patient must be kept perfectly quiet, and should be cautioned against any efforts. Wet compresses, if the patient can bear them, are very useful in this as in other diseases of the lung. Strips of plaster are very often applied round the affected side; some use a flannel bandage for the same purpose. If necessary, local anodynes or counter-irritants may be combined with mechanical rest by placing underneath the strapping a belladonna plaster or a a piece of spongio-piline sprinkled with diluted tincture of iodine. Immediate relief follows this or the other kind of treatment when properly carried out, and the patient in a very short time becomes able to breathe and cough without pain and dyspnœa. In strong and robust persons antiphlogistics are likely to be of service; cupping or leeches may be employed. When early adopted, the local abstraction of blood subdues the inflammation and relieves pain and dyspnœa and checks effusion. If the fever be high or persistent so as to consume the patient, vascular sedatives, as aconite and digitalis, in small doses, may be given with salines, and quinine. Dyspnœa due to œdema of the lung may be relieved by local bleeding. The disease, however, generally occurs in the weak, and rapidly runs on to effusion; it also leads to deterioration of the blood and to wasting as a consequence of the fever. In such cases roborant treatment is to be preferred to the antiphlogistic as the latter augments the tendency to prostration. Calomel, tartar-emetic, &c., should therefore be avoided, and the pain must be relieved by belladonna and opium, or the hypodermic injection of morphia. Where the cough is troublesome, carbonate of ammonia with cinchona may be given. The diet must be nutritious and liquid.

If these means fail, and considerable effusion takes place, we must endeavour to promote absorption by giving syrup of iodide of iron. Under the use of this remedy, the quantity of effusion is diminished and its absorption promoted. The application of tincture of iodine or large blisters may be tried, or mercurial ointment may be rubbed in. In such cases the patient should have a moderate diet

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free from stimulants. Besides free counter-irritation over the chest, purgatives and diuretics may be employed. The former, by diminishing the water of the blood, lead to the absorption of effusion. Spirit of juniper, squills, and bitartrate of potash are the best diuretics. Strapping the chest also aids absorption. Another method sometimes tried has been called the "thirst-cure." In this plan the patient's diet is almost entirely of a solid nature; a little fluid is allowed every three days. The effusion is said to decrease under the employment of this plan, but few patients can tolerate the withdrawal of fluids from their dietary. Another plan consists in the production of copious perspiration by means of jaborandi. One drachm of the liquid extract is given every three hours; it is said that very good results have followed the use of this remedy. If, however, the effusion remains in spite of all remedies; if it rises above the angle of the scapula, and its quantity undergoes no diminution for several weeks, it must be drawn off by operation in order to prevent further ill consequences. The first step is to pass a hypodermic syringe and ascertain the nature of the fluid. If this be purulent, two openings are needed, the first of which may be closed after the second has been made. If the fluid be serous it is not always necessary or desirable to empty the cavity. A fine trocar with an exhausting apparatus is the ordinary instrument for paracentesis. The patient should be in a semi-recumbent position with pillows under the shoulders. The fifth or sixth intercostal space, just in front of the angle of the scapula, is the best place for the opening, which should be made near the upper border of the lower rib, so as to avoid the intercostal vessels. The best plan is to make a lancet puncture on the lower rib, put a finger-nail into the puncture, and enter the trocar above the finger-nail. When the fluid ceases to run, the tube must be withdrawn, and the puncture must be closed with strapping. When the fluid is purulent it is better to draw off a portion of the fluid at first, and, a few days later, to introduce a sound through the opening and direct it towards the lowest part of the cavity. This being found, an incision is made upon the sound so as to allow the pus to escape. A drainage-tube should be inserted. These operations should always be performed with antiseptic precautions. Injections into the pleural cavity are not to be recommended.

Termination of empyema.—In favorable cases after free incision and antiseptic precautions, the cavity heals by granulation, and the two surfaces of the pleura freely adhere. The patient gains in weight, the temperature falls, the sleep is restored, appetite improves, the tongue becomes clean, the skin moist, and the night sweats cease. In unfavorable cases, the whole of the cavity is system and relieves dyspnœa. It is given with camphor or hypodermically injected. After the shock is relieved asphyxia is common where pneumothorax occurs at an early period of phthisis. The dyspnœa is best relieved by puncturing the thorax. The portal congestion can be subdued by saline aperients. In favorable cases secondary pleurisy may be treated by poultices or fomentations to the chest and by opium. The fever may be relieved by quinine and mineral acids. In the early stage, and when due to external injury, there is a tendency to hyperæmia of the lung. This is best treated by a few leeches, or even bleeding. The pain due to setting up of fresh pleurisy may be relieved by cold compresses, and rest may be procured by anodynes, especially by opium. Strapping the diseased side firmly, as for pleurisy, affords much relief.

MORBID GROWTHS IN THE PLEURA—CANCER—TUBERCLE.

The pleura is sometimes invaded by morbid growths: cancer of the pleura is extremely rare. It is never a primary affection. Cancer of the pleura is generally due to the extension of the disease from the breast, mediastinum, or lung. It sometimes follows operations on the breast for malignant growths. In rare cases the presence of a mammary cancer sets up inflammation in the pleura, and produces the usual results.

Cancer of the pleura shows itself in the form of extension of the original growth, or in that of independent nodules, varying in size, which appear on the surface of the membrane. The growth has a tendency to degenerate, and to cause septic or putrid effusion into the cavity. Its presence can rarely be detected during life. If there is pleural effusion after cancer of the breast it is probable that cancer also exists in the pleura.

In such cases the treatment is only palliative, as in the case of other cancerous growths which do not admit of operation.

Tubercles in the pleura.—Tubercular pleurisy is often met with. It is very common in weak and delicate subjects, and in the members of families already tainted with pulmonary consumption. It exists in four different forms. 1. It may be tubercular from the first. Grey miliary tubercle of the pleura occurs in cases of acute tuberculosis. 2. The patient may suffer from pleurisy, which may recur from time to time and ultimately end in phthisis. In these cases the tubercular granulations may develop in false membranes, and may grow from the pleura. 3. It may commence with pleuritic effusion and the tubercles soon arise in the condition. 4. It may supervene in the course of phthisis a consumption patient may suffer from circumscribed inflammation in different parts of the pleura.

Tubercular pleurisy rarely destroys life. It is commonly a part of general tuberculosis. Tubercle in the pleura may be suspected if a patient in delicate health suffers from repeated attacks of pleurisy without ending in effusion. The suspicion grows stronger if there is no very obvious cause for the attacks. The diagnosis is easy if pleurisy sets in in patients already suffering from pulmonary phthisis.

Symptoms.—Tubercle in the pleura may be suspected if in a case of what seems to be simple pleurisy apparent recovery takes place, but the temperature, which had fallen to a normal degree, rises again, and the pulse increases in frequency. Hectic fever and a short dry cough are other suspicious symptoms. On physical examination, there is found no pleuritic effusion nor any evidence of empyema, but only a beginning of a fresh attack of pleurisy or a sign of some mischief at the apex of the lung. Such cases generally end in phthisis.

The treatment of tubercular pleurisy is that of the two affections which are thus united. All lowering measures are of course out of place. Inflammation of the pleura, occurring in delicate subjects, should be very carefully watched. Counter-irritation by means of iodine paint and the administration of iodide of iron are the main remedies. The general treatment of tuberculosis must also be adopted.

DISEASES OF THE CIRCULATORY ORGANS.

DISEASES OF THE HEART.

The heart, like other organs, is subject to various organic and functional disorders. The organic cardiac diseases, or those which affect the tissues of the heart, include inflammation and various other disorders giving rise to local and general symptoms, and to special and general consequences. Of the diseases affecting the tissue endocarditis is the commonest and most important and therefore first described. Endocarditis gives rise to different forms of valvular diseases and to congenital malformations. Next in order are placed other structural changes affecting the walls of the heart, as myocarditis or inflammation of the muscular fibres of the heart. It is present in many cases of valvular disease resulting from endocarditis. Other structural changes of the walls of the heart include *hypertrophy*, or an increase in the volume of its muscular tissue, and *atrophy* of the cardiac muscles, as occurs in cases of general wasting of the muscular system generally. Another morbid condition of the heart is known as *dilatation*. In it the cavities of the heart are enlarged. *Degeneration* of the substance of the heart often occurs. It may be due to a kind of fatty deposit upon the surface of the heart, or to a fatty degeneration of the muscular fasciculi. Other degenerations rarely affect the heart. *Cancer* of the heart is extremely rare. *Syphilis* occasionally invades the heart. *Tubercles* are seldom met with embedded in its walls. *Parasitic growths* have been found to exist in the heart (cysticerci, as in other muscles of the body). Alteration of the contents, or cardiac fibrinous deposits known as *thrombosis*, is often found post-mortem in the right side of the heart. Other cardiac disorders, as displacements, are due to causes external to the heart. *Pericarditis* is an inflammatory disease affecting the membrane covering the heart. Adhesion of the pericardium and heart as a consequence of pericarditis also occurs. *Hydropericardium* or an increase of the normal fluid in the pericardial sac is also noticed. *Pneumopericardium* sometimes though rarely occurs. *Growths* sometimes exist within the pericardium, similar to those found within the heart. These are cancer and tubercles. The functional disorders of the heart include nervous derangements or neuroses. These are *palpitation* and *angina pectoris*. They also include *exophthalmic goitre* or Basedow's disease.

Diseases of the great vessels have been next treated. These include inflammation of the coats of the aorta and also a group of diseases known as aneurysms (thoracic and abdominal), obliteration of the aorta, &c.

ENDOCARDITIS.

Endocarditis is an inflammation of the lining membrane of the heart. The condition is unattended with any free exudation. It belongs to the class of *parenchymatous* inflammations. There is swelling of the endocardium, due to disturbance of nutrition, and accompanied by proliferation of cells. In process of time the cells become organised and form connective tissue. In very rare cases the inflammatory products degenerate and ulceration results. The disease especially attacks those portions which are most exposed to friction or any strain from the action of the heart. The superficial portions of the endocardium are generally affected. The portions thus involved include the orifices and valves of the heart. The disease rarely attacks the right side of the heart, except when it is congenital.

Causes.—The disease is seldom or never due to direct irritation or any traumatic cause. It is often associated with pericarditis, and both may be due to the same causes. As an idiopathic affection the disease is generally chronic. Little is known as to its causation in those cases of valvular disease in which there is no history of any previous illness of a severe character. The most common causes are exposure to cold and acute articular rheumatism. Statistics have shown that about 20 per cent. of cases of acute rheumatism suffer from endocarditis in the early stage. The next most frequent cause of endocarditis is acute and chronic Bright's disease. Endocarditis sometimes occurs during acute infectious fevers, as measles, typhoid, typhus, &c., and puerperal fever and septicæmia. In all these cases the blood contains some irritant which leads to secondary inflammation in various organs. In certain cases it is associated with chorea. The presence of a diseased valve sometimes causes endocarditis.

Post-mortem appearances.—The inflammation is rarely seen in the early stage. The most common congenital defects of the heart are due to the occurrence of endocarditis of the right side during fœtal life. Extra-uterine endocarditis is generally on the left. It is usually confined to patches of the endocardium, and chiefly to the orifices and valves. In endocarditis, if seen early, there is at first increased redness and vascularity; after a time there is thickening of the superficial portion of the membrane, which is also rough, opaque, and dry, and proliferation of cells beneath the endothelium.

In advanced cases, besides swelling of the endocardium, vegetations, villi or warty outgrowths or granulations are found upon the surface of the semilunar and ventricular valves, near their thin margins. These growths are firm at their base; their free ends are soft and jelly-like. Their bases are formed by connective tissue, the apices being filled by cells which are yet not organised. They affect the delicate chordæ tendineæ by contiguity. In process of time the growths become semi-cartilaginous and lead to thickening, puckering, or cohesion, or to retraction and shrinking of the valves in which they form warty or cauliflower-like masses. In very old cases the growths become calcified and appear of stony hardness. Ulcers are rarely found. Besides these changes, fibrin is often deposited upon their rough and uneven surfaces. These fibrinous deposits often become detached, either in particles as granules, or in masses, and form coagula (emboli), and these may be washed away and carried to the brain, leading to paralysis, or to the lungs, giving rise to hæmorrhagic infarction, or to other important organs, as the spleen. Emboli obstructing the vessels of the extremities lead to gangrene or other serious consequences. In some cases we notice laceration of the endocardium, chiefly the chordæ tendineæ, and also ulcerations from destruction of the tissues which have become soft. We also sometimes find purulent formations in the deeper layers, and in rare cases the formation of an acute aneurysm of the heart. A rapid breaking down of the endocardium in endocarditis causes the muscular walls of the heart to yield at a particular spot. It is nearly always at the apex of the left ventricle on the outer side, where the endocardium gives way. A dilatation is the result, and this may increase to almost any size. The orifice of communication with the left ventricle always remains small, being very rarely larger than a goosequill. Occasionally a rupture takes place between the layers of the valves, and this forms what is called an aneurysm of the valve.

Symptoms of endocarditis.—Endocarditis, when due to an attack of Bright's disease or pyæmia, generally remains undetected for some time; its existence is recognised only by the physical signs of valvular disease. Endocarditis may be suspected if, besides the symptoms of ill-health, with slight inflammatory fever and increased heat of skin, we find the pulse somewhat accelerated, the face extremely anxious, and that dyspnœa, palpitation of the heart and some obscure pain in the præcordia are present, although there is no acute pain nor tenderness, as in pericarditis. The development of endocarditis is rendered certain if there is a previous history of rheumatism and the physical signs point to newly-developed valvular disease, which is a most common sequel of endocarditis. In those cases in which endocarditis occurs in the course of an attack of rheumatism it may or may not give rise to any symptoms. When these are present they generally relate to functional disturbance of the heart. The most common symptoms are increased frequency of the pulse, which is also extremely small, palpitation of the heart, and passive hyperæmia of the lung, leading to dyspnœa. The smallness of the pulse is due to the reduction of the energy of the heart; the palpitation is caused by the infiltration of the muscular substance.

It cannot be said that there are any especially distinctive symptoms of endocarditis. The condition gradually merges into valvular disease. Pain is never present in uncomplicated cases. The existence of endocarditis can be detected by physical examination alone.

Physical signs.—The abnormal heart-sounds known as murmurs are not always indicative of endocarditis. Murmurs may be due to irregular tension of the valves. In endocarditis the inflammation is generally limited to patches, and almost always affects the left heart. Thus the valves and orifices, as well as the tendinous cords on that side, become affected, and certain murmurs may be heard. In endocarditis at first the impulse of the heart is stronger than usual, but subsequently the pulse becomes small and soft, owing to the feebleness of the heart's contraction. The inflammation being on the left side of the heart the flow of blood from the left auricle into the left ventricle is impeded. This has the immediate effect of impeding the flow from the pulmonary veins, and as a result there is accumulation of blood in the right chambers, which become dilated. Hence there is an increase in the cardiac dulness. As the disease progresses the valves undergo alterations; their tissue becomes soft and thickened. The diseased valves do not vibrate as in health, and, as a consequence, the heart-sounds are modified and murmurs are heard. In endocarditis the first sound which on the left side is due to the normal vibration of the healthy mitral valve is now altered in character, and is replaced by a murmur which is best heard at the apex. This mitral systolic murmur is the one most commonly heard in endocarditis, and is due to the thickening of the mitral valve at its outer edge, which prevents its complete closure. As a result there is regurgitation of blood from the ventricle into the auricle during the ventricular systole. The murmur so produced is known as the mitral regurgitant; it indicates insufficiency of the mitral valve. The second sound is produced by the vibration of the semilunar valves of the aorta, and is best heard at the base, whence it is conducted to the apex. In endocarditis affecting the mitral valve on its auricular surface the entrance of blood into the ventricle is accompanied by a murmur. This murmur is audible during the diastole of the ventricle or before its systole. The aortic valves are seldom affected in endocarditis, and hence aortic murmurs, whether systolic or diastolic, are rarely heard.

The pulmonary valves are very rarely affected, and hence there are no murmurs connected with these valves in endocarditis. On the contrary, we often hear the pulmonary second sound loud and intensified. The accentuation of the pulmonary second sound may be thus explained. In endocarditis the mitral valve usually becomes insufficient; the pulmonary artery is, therefore, distended, and its semilunar valves fall back with an increased shock. Endocarditis leading to roughness of the tricuspid valves is extremely rare, and when this latter condition occurs it is generally secondary to mitral stenosis or to mitral regurgitation.

Diagnosis.—In a case of acute rheumatism a murmur audible at the apex is not necessarily diagnostic of endocarditis. It may be dependent upon abnormal tension of a healthy valve, as a result of fever. If, however, the murmur be accompanied by intensification of the second pulmonary sound and increased cardiac dulness, the valve is certainly affected.

In patients who are suffering from a second or third attack of acute or subacute rheumatism it is difficult to determine whether a murmur, detected for the first time, indicates valvular disease of old standing or recent endocarditis. It may, indeed, be due to both of these causes. If the cardiac dulness be very considerable it may be assumed that the right ventricle is much dilated, and that there is valvular disease of old standing.

Prognosis.—Death rarely occurs suddenly in endocarditis associated with acute rheumatism. In a few cases of typhus fever, the fatal issue has been due to endocarditis. As a general rule the inflammation subsides, but the disease in itself is always serious, inasmuch as chronic valvular disease is a very common result. Perfect recovery is rare and fresh attacks are very prone to occur. Detachment of clots, which are conveyed as emboli, sometimes occurs and leads to cerebral softening. When symptoms of myocarditis are associated with those of inflammation of the lining membrane the case is almost certain to end fatally.

Treatment.—Attempts should be made to cure or lessen the severity of the disease in the progress of which the endocarditis occurs. When associated with rheumatic arthritis, in which there is present in the blood some poison (probably lactic acid), this should be neutralised by alkalies and chiefly by bicarbonate of potash. If these are not successful, the salicylate of soda should be tried. The timely use of the salicylates will often prevent the those cases in which endocarditis occurs in the course of an attack of rheumatism it may or may not give rise to any symptoms. When these are present they generally relate to functional disturbance of the heart. The most common symptoms are increased frequency of the pulse, which is also extremely small, palpitation of the heart, and passive hyperæmia of the lung, leading to dyspnœa. The smallness of the pulse is due to the reduction of the energy of the heart; the palpitation is caused by the infiltration of the muscular substance.

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A somewhat rare form of inflammation of the lining membrane is known as ulcerative endocarditis. In this variety the lining membrane of the left heart, especially about the valves, presents patches of loss of substance or erosions. Small quantities of pus are sometimes found in the deeper layers of the endocardium. The erosions may amount to ulcers, irregular in shape and with swollen and thickened edges. The ulcerated products, or the *débris*, are liable to be carried into the circulation and arrested in the brain, spleen, or kidneys. In a few cases secondary emboli are formed and find their way into the lungs. Besides the symptoms due to emboli, the results of the process infect the blood, act as septic agents, and excite suppurative inflammation in parts with which they come into contact. The symptoms are for the most part those of the general infection, and resemble either typhoid fever or pyæmia. Death is the almost invariable result. There are no *special* local symptoms, but a loud systolic murmur indicates the presence of a cardiac affection. Such cases occur during rheumatism, in puerperal women, and in the subjects of valvular disease. Quinine and the salicylates are the remedies upon which most reliance is to be placed.

VALVULAR DISEASES OF THE HEART.

The most common and most important affections of the heart, and those which most interfere with its functions and thus react upon the circulation, are the valvular diseases. This class includes lesions of the orifices and of the valves. The orifices are two auriculo-ventricular and two ventriculo-arterial; and of these, any one or more may become diseased in the same case. These orifices are specifically named mitral, aortic, tricuspid, and pulmonary. The diseases of the valves are of two kinds. The most important changes are known as insufficience and contraction respectively. The latter, known as stenosis or constriction of a valve, or rather of an orifice, gives rise to obstruction. In the former, the valve is incapable of complete closure, it therefore permits regurgitation of blood into the cavity. Thus during the ventricular systole, the mitral or the tricuspid valves being deformed, the whole contents of the ventricle are not thrown into the aorta or pulmonary artery, but a portion of the blood goes back into the auricle. Similarly during the ventricular diastole, the blood which has entered the aorta and pulmonary artery also regurgitates if the semilunar valves are insufficient. In obstructive disease or stenosis, the onward course of blood is obstructed, owing to constriction of the outlet. Obstructive and regurgitant diseases are often combined in the same individual.

All these changes in the valves have the effect of retarding the circulation of blood. Their influence upon the distribution of blood varies according to the seat of the disease.

Causes.—Most valvular lesions result from endocardial inflammation, which gives rise to a deposit of lymph upon and beneath the lining membrane, and the valves lose their thinness and brilliancy, become thick, indurated, and puckered up, or adherent to one another at their edges, or to the opposite walls. The proliferations very often undergo fibroid degeneration or even atheromatous or calcareous changes, and the valves are much altered in form. Sometimes they become covered with warty excrescences or vegetations. The inflammatory changes very often lead to constriction at or about the orifices, and to incompetence of the valves, by giving rise to thickening of the margins, or to nodulation, adhesions, ulceration, or even laceration of the valves. Besides acute endocarditis, valvular diseases may occur in connection with gout and Bright's disease. They are also sometimes due to violent physical work in young people, great pressure being thrown upon the valves. Pressure of a tumour from without, and twisting of the orifices of the heart, as in cases of displacement of that organ, lead to valvular disease. Congenital malformations, as deficiency of a part of the ventricular septum, or occlusion of the pulmonary artery, give rise to a pulmonic valve-lesion. Dilatation of the ventricles and degeneration of the great arteries are other causes of regurgitant valvular disease.

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Symptoms.—The symptoms produced by valvular disease of whatever variety are conveniently classified as those due to the effects produced in front of and behind the lesion respectively. In every case there is (1) retardation of the circulation; (2) too great fulness of the venous and too great emptiness of the arterial system; (3) malnutrition of the heart itself; and (4) the effects of emboli are sometimes observed. The lesions, therefore, give rise to important disturbances in the circulation and secondary changes in the condition of the heart. All valvular diseases obstruct the steady course of the blood-current; in insufficience they permit of its regurgitation. In stenosis, where the orifices are narrowed, the diseased valves directly obstruct the normal onward flow and prevent the passage of the blood from those parts of the circulation which are behind the narrowed orifice. Thus, in mitral stenosis the flow is obstructed from the left auricle and parts behind it; in aortic stenosis from the left ventricle and parts behind it. In regurgitation the valves are insufficient to guard the orifices, which become dilated. The onward passage of the blood is indirectly prevented, and some of the blood, which should pass forwards, now flows backwards through the dilated orifices. Thus, in mitral regurgitation the blood flows backwards from the left ventricle into the left auricle, and in aortic regurgitation from the aorta into the left ventricle.

The effects of these alterations vary with the amount of alteration in the valves, and are best manifested by changes behind and by changes in front of the lesion. Those behind the lesion occur in the cavities of the heart and in the circulation behind the affected valves, or in the venous circulation. The changes in front of the affected valve are manifested by altered conditions of the arterial circulation.

Physical signs.—During health the normal operation of the valves of the heart is as follows: With the contraction or systole of the left ventricle the mitral valve is closed, and if competent it prevents the blood from flowing back into the auricle: the patency of the aortic valves, which are laid back, allows the blood to go freely away on its circuit. With the diastole or dilatation or filling up of the left ventricle the mitral valves open, and the aortic valves are closed. During disease, when one or more of these valves are implicated, their healthy action is interfered with, and abnormal sounds are produced, known as *murmurs* or "bruits." These are produced within the heart and at any one of the four orifices, and vary with the situation and condition of the affected part. They either replace the normal sounds or are superadded to them.

In valvular diseases murmurs are due to some disproportion in the relationship between the force of circulation of the blood and the cardiac orifices. They are the result of molecular vibrations or oscillations in the blood-current, which are modified or rendered intense or low by disease of the valves. These murmurs, which are caused by obstructions in the circulation, are termed *organic* murmurs, to distinguish them from those which occur independently of such obstacles in a heart whose structure is healthy. Murmurs of this latter kind are called *inorganic*. The oscillations of the current of blood in cases of constriction of an orifice are due to the abnormal force with which the blood is driven through the narrowed aperture. In valvular insufficiency the oscillations are caused by the regurgitation of a portion of the blood through the aperture, which is only partially closed. There is a wave backward in addition to the normal one in a forward direction, and these two currents come into collision, and a murmur is caused. The murmurs are often intensified by the movements of the blood being communicated to the degenerated valves. Murmurs vary much in *character*. They are usually of the kind denominated "blowing" or "softly aspirated," but sometimes they are of a rough, sawing, scraping, or whistling character. Again, there is considerable variation as regards *intensity*. Some murmurs are faint, soft, and scarcely audible; others are loud, are heard all over the chest in front, and sometimes even at a distance from the chest-wall. They always become more audible when the heart is beating strongly; their intensity is by no means always in proportion to the gravity of the lesion, save in the case of those which result from a constricted orifice. In these cases the degree of contraction influences the intensity of the murmur.

Murmurs also vary in *duration*; some are short; others occupy the whole of the systole or diastole; and if two murmurs be present they may be almost continuous. A murmur may completely obliterate the normal heart sound, or the latter may remain more or less audible. *Diastolic murmurs* are always the result of structural changes; *systolic murmurs*, besides being thus caused, may be also due to various other conditions. Thus, they may be caused by unequal tension of the segments of the mitral valve, and by a similar condition of the walls of the pulmonary artery. Systolic murmurs of this kind (inorganic) are often heard in cases of anæmia and of acute febrile diseases.

Besides being due to valvular diseases, organic murmurs are sometimes caused by other conditions. Thus, they may result from —1. Roughness of the endocardium or a tendinous cord stretching across the left ventricle. A murmur thus produced during systole is known as a non-regurgitant or intraventricular murmur. Fibrinous coagula among the columnæ carneæ also cause these murmurs. 2. Abnormal condition of vessels, as aneurysm. In aneurysm a column of blood within the sac is thrown into oscillation at each successive contraction of the ventricle. 3. Pressure of a tumour on a vessel. 4. Abnormal condition of the heart, as dilatation of its cavities. The murmurs depend on the irregular oscillations of the blood and the valves. 5. Congenital malformations, as deficiency of a part of the ventricular septum and obstruction of the pulmonary artery give rise to murmurs.

Lesions of the Mitral Valve.

The most frequent of these is *insufficience*, a condition which permits the return of blood from the ventricle into the auricle. The effect is manifested by a systolic murmur, heard in its greatest intensity at the apex of the heart. The systolic sound is either absent or more or less distinct. Like other organic murmurs, mitral regurgitant murmur is best heard when the patient is in the erect position.

Causes.—The insufficient state of the valves is generally the result of inflammation, as myocarditis, or endocarditis. There is contraction or puckering of the free edges of the cusps so that they cannot meet together. Shortening and rupture of the chordæ tendineæ and perforation of the valves also lead to insufficience.

Post-mortem appearances.—In regurgitation there is more or less contraction and narrowing of the valves and shortening of the valve-tips, with irregularity, thickening, and rigidity. The valves often enclose plates of calcareous matter and are sometimes atheromatous. The tender web on the edge of the valve disappears, and its place is taken by a thick, irregularly-formed pad, upon which the chordæ tendineæ are inserted. Laceration or rupture, adhesions and fibrinous deposits are found in some cases. The chordæ tendineæ sometimes give way; the segments of the valve are covered with vegetations, they are inverted by the force of the blood, and are made to flap into the auricles. In this lesion the backward effects on the cavities and walls of the heart are severe and important. The left auricle becomes dilated and hypertrophied; the pulmonary artery and the pulmonary veins are also dilated, and the process extends to the right cavities. The left ventricle is dilated, and in long-continued cases its lining membrane often undergoes degeneration, becomes thickened, opaque, and atheromatous. As in aortic disease where the obstacle to the circulation is combated by hypertrophy of the left ventricle, so in mitral insufficiency there is compensatory hypertrophy of the right ventricle. In mitral regurgitant disease during ventricular systole, part of the blood regurgitates into the auricle, and hence the amount propelled into the general circulation is smaller than natural, and the circulation is therefore retarded; there is less blood in the aortic system, and the venous system is overloaded.

Symptoms.—In mitral disease the compensatory hypertrophy of the right ventricle obviates for a time and to a greater or less extent the overcharge of the whole venous system. In the earlier stages, the hypertrophied and dilated right ventricle propels the blood with increased force into the pulmonary circuit, and it thence is driven into the left cavities and onward into the aortic circulation. From the commencement there is always more or less hyperæmia of the lung, and this condition gives rise to dyspnœa or shortness of breath. The bronchial vessels are also affected, and there is generally some amount of catarrh. These symptoms are aggravated by exertion. The catarrhal affections of the lungs and bronchi lead to œdema and effusion of pituitous serum into the air-cells of the lungs, and sometimes cause symptoms of carbonic acid poisoning. The disease, however, may last for years with dyspnœa as the only symptom. The condition of the patient as regards symptoms is considerably influenced by the circumstances of his life, occupation, &c. If mental and bodily rest and ordinary comforts can be obtained, many years may elapse before any very serious symptoms occur. On the other hand, laborious occupation, mental anxiety, exposure to vicissitudes of temperature, &c., have a very unfavorable influence and rapidly cause marked symptoms and a fatal issue. Patients suffering from mitral disease are generally pale-looking from want of blood in the arteries, although there may be no venous engorgement owing to the blood being collected in the pulmonary circulation. Constriction is often combined with insufficience.

In advanced cases the compensatory hypertrophy of the right ventricle is no longer sufficient, and the contents of the aorta become less and less. The systemic venous system becomes engorged and the lips and face are blue and slightly swollen. The congestion in the cerebral veins causes headache. Dropsy is one of the most constant symptoms; it commences in the feet, and extends upwards over the thighs, genitals, &c. Dropsical effusions also occur in the serous sacs, as the peritoneum, pleura, and pericardium. The anasarca is most marked at night, and is frequently absent in the morning. Engorgement of the veins of the stomach and intestine leads to chronic gastric and intestinal catarrh. The tongue, though clean, is often covered with thick and viscid saliva. The appetite is generally diminished, but sometimes voracious. Engorgement of the liver causes enlargement with oppression in the right hypochondrium, and the obstruction of the hepatic veins may lead to jaundice. The kidneys being engorged, the urine is generally scanty, often albuminous, and contains abundant urates, with blood-corpuscles and casts. When the secretion is abundant, there is generally no albumen. The systemic venous engorgement also obstructs the thoracic duct, and thus impedes the supply of nutritive materials to the blood. As the case progresses the dropsy and the dyspnœa become more marked and severe. The transudation of serum into the air-cells of the lung leads to carbonic-acid poisoning and stupor, which ends in death. General dropsy and œdema of the lung are the ordinary modes of termination, and when they exist the condition of the patient becomes desperate. The disease rarely ends in sudden death. In a few cases death is due to hæmorrhagic infarction of the lung. Emboli may be carried from the right side of the heart into the lungs, and cause pulmonary infarctions, which in these cases are generally found in the interior of the lung, near the root. Smaller peripheral infarctions also occur as a result of heart disease.

Physical signs of mitral regurgitation or incompetence.—On *inspection* and *palpation* we notice increased impulse, sometimes so forcible as to elevate with each pulsation a large part of the chest-wall. There is alteration of the position of the apex, which is displaced downwards and outwards. When the right ventricle is hypertrophied there is marked pulsation in the epigastrium. True pulsation of the veins does not occur unless the tricuspid valve is also diseased, but sometimes a rhythmical pulsation of the jugulars, isochronous with the heart's systole, is visible. This proceeds from the transmission of a wave of vibration from the tricuspid valve. On *percussion* the cardiac dulness is found to be increased in breadth in proportion to the enlargement of the right ventricle. On *auscultation* a loud systolic murmur is heard, replacing or immediately following the first sound. It is often more clearly heard above and to the outside of the normal position of the apex. Owing to the hypertrophy of the right ventricle the left ventricle is pushed from the thoracic wall, and the murmur is conducted laterally, on a level with the apex upwards and outwards, round the left side of the chest. It can frequently be heard in the left axilla, at the lower angle of the left scapula, and also between this bone and the spine. It diminishes in tone from the apex to the base, where the heart is covered by the lung. In very rare cases the murmur presents the greatest intensity over its point of origin, that is, in the second left intercostal space. The cause of this anomaly is supposed to be hypertrophy of the left auricular appendix. The systolic non-regurgitant or anæmic murmurs are not transmitted in the above-mentioned directions. The second sound heard over the aorta is normal or feeble, but it is intensified over the pulmonary artery. This is owing to the fact that a small amount of blood passes from the ventricle into the aorta. In the case of the pulmonary artery the closure takes place under increased pressure. The arterial system is insufficiently supplied with blood, and there is extreme anæmia, and though the heart may be acting violently, and the large arteries in the neck throb, they contain less blood than in the normal condition. The pulse is small, weak, and easily compressible; low tension and inequality in the size of the pulsations are shown by the sphygmograph. Later on the pulse becomes irregular and intermittent.

Mitral obstructive lesions or Constriction of the left auriculo-ventricular orifice.

A diastolic or præsystolic murmur, loudest at the apex, is characteristic of a contracted mitral orifice. Mitral stenosis, or obstructive mitral valve-disease, often accompanies mitral insufficience. It is a consequence of myo- or endo-carditis, and may depend on cohesion of the edges of the valves, so that the ring becomes contracted, or the valves may become thick, and the valve-tips adhere to each other. An inflammatory condition of the valves, deposits, and granular excrescences may also be due to atheromatous changes.

Post-mortem appearances.—The valves are narrowed and thickened, and covered with vegetations, and the lower edges of the valve-tips are sometimes united, so as to make a funnel, broad towards the auricle, and ending in a narrow opening, perhaps barely large enough to admit the tip of the finger. The vegetations which cover the valve also help to block up the orifice. In the normal heart, the mitral orifice will admit two fingers at least, of ordinary size, and a third introduced from below for a little distance between them. In mitral stenosis the ordinary effects upon the heart are: (1) normal or small size of the left ventricle, and sometimes abnormal thinness of its walls; (2) engorgement and dilatation with excentric hypertrophy of the left auricle, and hypertrophy and dilatation of the right ventricle. There is dilatation and engorgement of the pulmonary artery and veins, and in advanced cases œdema of the lungs, bronchial catarrh, pulmonary hæmorrhage, and sometimes effusion into the serous cavities. There are also indications of congestion of the whole venous system, this condition being specially marked in the liver, the brain, kidneys, and other important organs. Towards the end, the triscuspid valves often become incompetent.

Symptoms of mitral obstruction.—These are for the most part the same as those of mitral regurgitation. The blood during diastole does not flow into the ventricle freely as in health, and hence the circulation is retarded. In it, as in regurgitation, the aortic circulation contains too little blood, and the pulmonary circuit is engorged. In stenosis the distress is greater than when insufficiency alone exists. This is particularly to be observed when the patient is suffering from bronchitis. The dyspnœa is intense; the patient is unable to lie down; at the same time there is often a very copious watery sputum. This was noticed before auscultation of the heart was practised, and the sputum was then designated pituitous. Other symptoms of mitral obstructive lesions are general dropsy and cyanosis. In the early stage both are absent. In advanced cases they are most marked owing to the engorgement of the venous circulation which takes place as soon as the compensatory hypertrophy of the right ventricle has reached its limits. The pulse is small at first, and after dilatation has set in it becomes weak and irregular. The sphygmograph shows a small pulse of low tension and unequal volume of the beats. The extremities are cold, and are insufficiently supplied with blood necessary for nutrition. Other symptoms connected with the liver, kidneys, and stomach are the same as those occurring in mitral insufficiency.

Physical signs of mitral obstruction.—On *inspection*, *palpation*, and *percussion* the physical signs are those of excentric hypertrophy of the right heart. The impulse of the heart is felt to the right of its normal place. The impulse is not so strong as in mitral insufficience, because the left side of the heart does not share in the hypertrophy. On *palpation* a thrill is felt, and this is caused by the current of blood being agitated or thrown into eddies in passing from the left auricle into the ventricle. This can be felt most distinctly at the apex; it exists in every case of marked constriction, and is intensified after the patient has moved about a little. It either continues throughout the whole of the diastole, or is felt only at the end of it just before the systole, hence it is termed either *diastolic* or *præsystolic* thrill. On *auscultation* we hear a diastolic or præsystolic murmur, loudest at the apex and over the chest-wall immediately adjoining it to the right. Its quality is not uniform during the period of its duration; it is generally divided into two or three portions, not separated by any pause, but differing in character and loudness. It is at first soft and feeble, then it becomes louder, and finally rough or grating in quality. The greater the rapidity with which the blood is poured in and the rougher the surface of the contracted portion, the louder the sound becomes. In some cases no murmur is audible until just before the systole. Sometimes the præsystolic murmur is scarcely audible, especially if the heart be acting very feebly. As it almost always happens that stenosis of the mitral orifice is complicated by insufficiency of the mitral valve, this præsystolic murmur often passes at once into the systolic murmur caused by the insufficiency. When the state of constriction is far advanced the pressure of the blood when the ventricle contracts may almost close the contracted orifice and thus prevent regurgitation. In this case there will be little or no systolic murmur. Intensification of the second pulmonary arterial sound is always present in cases of constriction of the mitral valve. Reduplication of the second sound is frequently heard in this condition, and is most defined over the lower portion of the sternum and near the apex of the heart. It is generally most appreciable when the heart's action is slow and tranquil; if the heart beats quickly and forcibly the two sounds usually merge into a diastolic murmur.

Aortic Valve-lesions—Insufficiency of the Semilunar Valve.

Closure of the semilunar valves is due to a mechanical cause, inasmuch as it is effected by the recoil of the column of blood during the ventricular diastole. The blood presses together the semilunar valves, which are pushed up against the walls of the aorta during the systole. The closure of the auriculo-ventricular valves is effected in a different manner; it requires the contraction of the papillary muscles. Aortic regurgitation occurs if, during the diastole of the ventricle, the valves do not form a complete partition between the blood in the aorta and the ventricle. The valves are then said to be insufficient.

Causes.—Changes in the valves, causing insufficience, are the result of endocarditis, and, more frequently, of chronic arteritis, leading to atheroma and calcification. These latter changes are common in old people and in persons who are habitually engaged in violent physical work.

Post-mortem appearances.—In aortic insufficiency the segments of the valve are shrunken and shortened; they often project inwards and form a cone towards the ventricle. In other cases there is thickening and rigidity of the segments; sometimes they are adherent to the aortic walls, less commonly the valve appears lacerated, or one of its segments is detached from its insertion. The sufficiency is tested by pouring water into the aorta, all coagula being first carefully removed. The heart must be so held that the plane of the orifice is perfectly horizontal. In aortic incompetence, the blood regurgitates from the aorta into the left ventricle, because the edges of the valves do not touch. The pressure of blood on the relaxed walls of the ventricle, and the impaired nutrition of its tissue, due to the interference with the coronary circulation, lead to dilatation. The dilated ventricle has thus to propel an increased volume of blood with greater effort, and excentric hypertrophy is the result. The wall of the ventricle is sometimes an inch thick, and the cavity is capable of holding a fist. The heart is often degenerated owing to deficient circulation of blood in the coronary arteries. Insufficiency is a frequent complication of contraction of the orifice.

Symptoms of aortic regurgitation.—As a forward effect, the circulation is retarded, the systemic arteries are imperfectly filled, and the pulmonary vessels are overloaded. In the early stage there is at first compensatory hypertrophy of the left ventricle, which thus prevents the diseased valves from producing bad effects on the pulmonary venous circulation, and hence cyanosis and dropsy do not occur. The valves being diseased the blood returns to the lungs with diminished frequency and is therefore more venous than usual. The hypertrophy tends to remedy this abnormality. During systole, a very small quantity goes into the aorta owing to some of the blood being returned, but the hypertrophied ventricle sends the blood with greater force and frequency, and hence the aorta and its branches are not inadequately filled, nor are the pulmonary veins engorged with blood. Thus people sometimes live for years in fair or even good health with extensive aortic disease. They do not even suffer from dyspnœa as patients with mitral disease always do. There may be some palpitation of the heart, but it is not constant. Sometimes the patients complain of pain in the chest and left arm and of some of the symptoms of angina pectoris. In insufficience when the hypertrophy is in excess of that required as compensation for the diseased valves, symptoms of excessive action of the heart are prone to occur. Thus patients complain of a feeling of oppression or discomfort in the præcordial region, of dizziness, headache, and spots before the eyes. The period of discomfort sometimes ends suddenly in apoplexy. Another cause of sudden death is degeneration of the walls of the heart. In advanced cases fibrinous clots sometimes become detached from the diseased valves, and give rise to signs of embolism in the brain. Sudden death not unfrequently occurs from this cause. More rarely asthmatic attacks occur. Very often the mitral valves become secondarily affected, and the symptoms of mitral regurgitation are superadded. Owing to this complication, symptoms of engorged lung, cyanosis, dyspnœa, and dropsy soon become prominent. Death is due to pulmonary œdema.

Physical signs.—Inspection and palpation.—There are signs of hypertrophy of the left ventricle. A bulging in the præcordial region can often be seen and felt. The position of the apex beat is considerably altered. It may be as low as the eighth rib and is often considerably to the outer side. The impulse is increased and takes on a heaving character. The chest at that portion appears as if lifted up. *Percussion.*—The heart is elongated, the cardiac dulness is increased in length and intensity. The *pulse* has a characteristic jerking quality; it is generally sudden and sharply defined. The sphygmograph shows a vertical upstroke or even one that slopes backwards, the line of descent falls rapidly and presents secondary waves. The dicrotic wave is wanting or feebly marked. The arteries distant from the heart appear tortuous and pulsating, elongated and moveable with each systole. Owing to the vibration of their walls, even the smaller arteries produce a sound during their expansion. The jerking quality of the pulse is due to the fact that the artery which is quickly and forcibly distended during systole is emptied in two directions during diastole. The carotids pulsate in a peculiar manner, and a murmur takes the place of the second arterial sound. *Auscultation.*—There is always a well-marked diastolic murmur replacing, or in rare cases accompanying the second sound of the heart. In the latter case it may be supposed that one segment of the valve is healthy. The murmur is due to irregular vibration caused by imperfect tension of the diseased valves. It is generally prolonged up to the commencement of the systole. It is heard very distinctly in the second right intercostal space at the sternal insertion of the third rib. It is propagated in the direction of the blood, and is often louder over the sternum than elsewhere. It may also be heard at the sides of the chest and along the vertebræ. In cases of pure insufficience the first sound as heard at the aorta is unaffected, but where the orifice is also the seat of constriction the first sound is modified. A pause generally exists between the two murmurs, but occasionally one passes into the other. The diastolic aortic murmur is longer in duration than the systolic murmur at the same orifice. It is more uniform in character than the diastolic mitral murmur, not being divided into portions, but of the same quality and intensity throughout the whole of the diastole. It resembles this murmur, however, as regards duration.

Aortic Obstruction or Constriction of the Aortic Orifice.

This exists when, during the systole of the left ventricle, the semilunar valves do not yield to the force of blood, and lie back against the walls of the aorta, but project in the form of a cone with the apex upwards towards the aorta. It rarely occurs from contraction of the aorta at the point where the valves are inserted.

Causes of aortic obstruction.—The state of the valves may be due to inflammation of the endocardium or to chronic lesions, as atheroma, vegetations, or cartilaginous deposits. These may obstruct the passage of blood into the aorta, or occasion roughness of the surface over which the blood passes. The disease generally occurs at an advanced period of life, and is slow in progress.

Morbid appearances.—In aortic obstruction the mouth of the aorta is narrowed, sometimes to such an extent as barely to admit a little finger. There is simple hypertrophy of the left ventricle, and the walls are very thick owing to the great amount of effort required to propel the blood through the narrow orifice. During diastole there is no increase of pressure, and hence the ventricle is not dilated. When aortic insufficiency coexists we find excentric hypertrophy of the left ventricle. Aortic regurgitation and obstruction often coexist. In obstruction the segments of the valve are thick, rigid, and shrunken, and sometimes coherent. The valves are very often covered with fibrinous masses, old vegetations, or calcareous deposits, and the opening of the artery is thus further contracted. The condition of the valve is often such that during systole the stream of blood cannot force the flaps back against the aortic wall, neither can the weight of the blood force them together again during diastole.

Symptoms.—The backward effect of aortic obstruction is to cause venous engorgement, but owing to hypertrophy of the left ventricle this consequence is prevented for a time. The ventricle is not dilated, and there are no symptoms of engorgement of the lung or of the systemic veins until a later stage. The forward effect of stenosis is to retard the arterial circulation. The aorta and its branches are inadequately filled with blood. There is therefore general pallor and palpitation of the heart, with symptoms of anæmia of the brain. Even in cases where both diseases of the aortic valves coexist there may be little suffering for years. The third main group of symptoms may appear suddenly and in a remarkable manner in patients who have enjoyed comparative comfort for years. In them fibrinous clots become detached from the valves, and give rise to signs of emboli in the brain, lungs, liver, or kidneys. Very often the hypertrophied heart becomes degenerated, or mitral insufficience, due to increased original aortic defect, or atheroma of the aorta occurs. In such cases the hypertrophy is no longer able to compensate the defect. The patients grow short of breath, and cyanosis and dropsy set in, and are followed by death.

Physical signs of aortic obstruction.—On *inspection, palpation,* and *percussion*, we find the same results as in simple hypertrophy of the left ventricle. The impulse is powerful, and the apex is displaced downwards and outwards.

Palpation.—There is sometimes systolic thrill in the second right intercostal space close to the sternum, and radiating downwards and to the right.

Auscultation.—A loud systolic murmur is heard, often masking the first sound, from the commencement of the systole and during the whole of the systolic period. The murmur is loudest at the base of the heart, and in the second right intercostal space at the sternal insertion of the third rib, and is of equal intensity over the whole of the upper part of the sternum. It is often distinct towards the right clavicle, and even in the right carotid, sometimes even in the descending aorta and in the back, the murmur diminishing as the stethoscope is moved from the base towards the apex. It is synchronous with the pulse, and also with the impulse. If regurgitation coexists there will be a diastolic murmur over the aorta, the second sound over the pulmonary artery being unaffected. In pure constriction the pulse is small and compressible, and is slowly developed under the finger. The sphygmograph shows the line of ascent to be oblique and short; the apex of the tracing is sometimes rounded, the line of descent is gradual, and there are few, if any, dicrotic waves. In this condition the hypertrophied heart is subject to degeneration, owing to the defective supply of blood in the coronary vessels.

Valvular affections of the right side of the heart.

Tricuspid insufficiency often results from disease of the left side of the heart. Primary and independent lesions of this valve are very rare, but the combination of mitral with tricuspid deficiency is often met with. *Constriction* of the tricuspid has been found only in a few cases.

Post-mortem appearances.—The orifice may be simply dilated, or the valves may be thickened, contracted, and deformed and covered with fibrinous deposit. The right venticle is hypertrophied. Mitral lesions are almost always prominent.

Symptoms.—In tricuspid insufficiency, when the right ventricle contracts, some of the blood regurgitates into the right auricle and venæ cavæ. These veins become dilated, and the pulsation due to the regurgitation is transmitted to the veins in the neck. The jugular veins can be seen and felt to pulsate. The systemic veins become engorged, and cyanosis and dropsy are the result.

Physical signs.—The cardiac dulness is increased in breadth. Tricuspid insufficiency generally causes a soft systolic murmur, most clearly heard over the lower part of the sternum; and sometimes enfeeblement of the second pulmonary arterial sound, the blood-pressure within the pulmonary artery being considerably lowered. The murmur is sometimes absent, but when present, and systolic pulsation in the neck co-exists, the diagnosis is clear. Tricuspid constriction causes a harsh diastolic or præsystolic murmur, loudest over the lower part of the sternum. It also gives rise to præsystolic pulsation of the jugular veins. The murmur is not propagated towards the left side of the heart and is not audible behind. Constriction of the tricuspid orifice sometimes causes a diastolic thrill.

Insufficience of the valves of the pulmonary artery rarely occurs, as the right side of the heart is almost exempt from endocarditis, and the pulmonary artery is seldom attacked by atheroma. When the lesion occurs, it is generally associated with constriction of the orifice.

Post-mortem appearances.—As far as the valve is concerned, these are the same as those met with in aortic insufficiency. The right ventricle is hypertrophied.

Symptoms.—Owing to the hypertrophy of the ventricle the lungs contain a considerable quantity of blood. There is dyspnœa, and other signs of congestion. Hæmorrhagic infarction of the lung has been noticed. Cyanosis and dropsy set in sooner or later.

Physical signs.—The cardiac dulness is increased in breadth, owing to hypertrophy and dilatation of the right ventricle. On *auscultation* a diastolic murmur is heard in the second left intercostal space.

Constriction of the pulmonary orifice, a very rare condition, may be due to the causes which produce aortic constriction, but it sometimes arises from induration of the infundibulum, or conus arteriosus.

Post-mortem appearances.—These are thickenings, contraction, and roughening of the valve, and hypertrophy and dilatation of the right ventricle. Induration of the first part of the artery may be present.

Symptoms.—These are much the same as those of insufficience; the two conditions are generally combined. The signs of venous engorgement are more marked than in cases of insufficiency.

Physical signs.—Increased cardiac dulness, owing to hypertrophy and dilatation of the right ventricle. *Auscultation* detects a loud systolic murmur, most marked in the second left intercostal space, close to the sternum. It is not generally conducted across this bone, nor upwards to the right, like an aortic murmur; but it may be heard over the upper region of the chest on the left side. Murmurs connected with the pulmonary artery are most distinct exactly over the pulmonary orifice, that is, close to the sternal insertion of the third rib on the left side. It must be remembered that inorganic or anæmic murmurs occur most frequently at the pulmonary orifice. They are always systolic, and are very commonly combined with murmurs in the veins of the neck.

Table showing the *rhythm*, *place where best heard*, and *the direction* in which the murmurs are *propagated*.

Mitral insufficiency . . .	A mitral *systolic* murmur, best audible at *apex*, traceable *upwards* and to the inferior angle of the left scapula.
Mitral obstruction, stenosis, or roughness of the mitral orifice.	A *diastolic* or *præsystolic* murmur, loudest at *apex*, propagated over a limited area and to the right.
Aortic insufficiency . . .	A *diastolic* murmur, best audible at *base*, third right cartilage, propagated *downwards* over the sternum (best conductor), traced to right side and lower end of that bone.
Aortic obstruction, stenosis or roughening.	A *systolic* murmur, audible at *base*, third right cartilage, traced *upwards* along the aorta and into the great vessels in the neck.
Pulmonary insufficiency (extremely rare).	Pulmonary *diastolic* murmur, best heard in second left intercostal space, and traced *downwards* towards the lower end of the sternum.
Pulmonary constriction or roughening (very rare).	Pulmonary *systolic*, most marked in second left intercostal space, close to the sternum.
Tricuspid insufficiency .	*Systolic*, most distinct over lower part of sternum, and traced *backwards* and *upwards* towards the right axilla.
Tricuspid constriction (very rare)	A *diastolic* or *præsystolic* murmur, best heard over lower part of sternum, not propagated toward the left side.

ing in character; the pericardial murmurs are suggestive of a light rubbing, grating or friction sound; they are also more superficial and become intensified on pressure of the ear upon the chest.

3. *The rhythm.*—The pericardial murmur is generally produced during both the systole and diastole of the heart. It is a double, "to and fro," friction murmur, but unlike double endocardial murmurs (aortic stenosis and regurgitant combined). The pericardial murmurs do not exactly correspond, (*i. e.* are not synchronous) with the heart-sounds. The pleural murmur is also a "to and fro" sound, but this corresponds in frequency with inspiration and expiration, and not, as the pericardial murmur, with the movements of the heart.

4. *Position of the murmur.*—Exocardial murmur, and chiefly the pericardial, often changes its place with the change in the position of the patient, owing to alterations in the relative position of the two roughened surfaces of the pericardium. The rhythm is also variable from day to day or from hour to hour. The endocardial murmurs on the other hand are fixed.

5. *The area or the extent of the surface occupied by the murmur.*—The exocardial (pericardial) murmur is heard at indefinite points over the pericardium. It is sometimes most distinct at the base and sometimes at the apex. It is not propagated to any distance, but often disappears altogether at a little distance from its origin. The endocardial murmurs are propagated in different directions according to the course of any particular blood-current and are best heard at certain definite points.

6. *The condition of the circulation.*—With exocardial (pericardial) murmur, or a to and fro friction murmur, the pulse is usually accelerated: with endocardial (aortic double) murmur, the pulse is of normal frequency, but is jerking, tortuous, visible, and collapsing in character.

7. *Co-existence of fremitus on palpation.*—Well-marked superficial fremitus generally accompanies pericardial friction murmur.

Prognosis.—The prognosis in cases of valvular diseases of the heart must always be a guarded one, for unexpected alterations frequently take place. There is in the museum of the College of Physicians of London the heart of a Fellow of the College who died in the last century at the age of more than eighty years. It exhibits extreme disease of one of the flaps of the aortic valve, and calcification of the coronary arteries. The aortic lesion almost certainly began early in life. But this must be regarded as an almost exceptional case, and it may be laid down as a first principle that valvular disease materially shortens life, and the earlier in life it begins the more disastrous are its consequences. Children born with congenital malformation rarely exceed the age of three years. One reason why valvular disease in childhood is likely to have more serious consequences than the same lesion later on, is that the growth as well as the nutrition of the heart is interfered with. Moreover, the mischief does not remain stationary. A child who gets valvular lesion under the age of five can hardly be expected to attain the age of thirty years. The habits and opportunities of the individual affect his heart, as also all his tissues, and good food, mental and bodily rest, and care, will enable such patients to live much longer than they would under opposite circumstances. In poor persons, obliged to work, valvular lesions soon produce fatal consequences.

In all cases of valvular lesion nature makes compensatory efforts in order to obviate danger. Thus, in aortic stenosis the excentric hypertrophy of the left ventricle is a compensatory change, and hence, a long time may elapse before any marked symptoms arise. These compensatory efforts vary in different cases, according to the extent of the lesion and the individual peculiarities. In persons in robust health the compensatory effort is often great and adequate for a time, even though the lesion be very serious. In other cases the tissues are prone to degeneration or decay, and in them the lesion is extensive, the heart soon degenerates, the compensation is extremely slight, and soon becomes inadequate, and serious consequences speedily follow. The *form* of valvular disease is an important element in prognosis. In *mitral* disease death is usually gradual; in *aortic* regurgitant disease it may be gradual, but is often sudden, and is due to syncope. Cases of mitral obstruction terminate much sooner than those of mitral regurgitation. Of all forms of valvular disease, aortic obstruction may be regarded as the least dangerous to life. Renal complications and lung-disease frequently terminate the lives of persons having any form of valvular disease. It must be borne in mind that various accidents are liable to occur: thus, hemiplegia or infarction of the lung may suddenly cause the case to become very serious. The extent of dropsy is not always to be taken as an index of the danger of the case, as persons with very extensive dropsy frequently recover for a time when given rest and proper treatment; but repeated attacks of faintness, of angina, or of urgent dyspnœa are always of grave import. Persistent albuminuria is, of course, a very serious symptom. Atheroma of the arteries likewise increases the danger.

Treatment.—Valvular affections are incurable; the lesions have a tendency to increase, the secondary effects are hypertrophy and dilatation of the chambers of the heart, and hyperæmia of the lungs. Our objects ought, therefore, to be—1, to prevent further mischief ing in character; the pericardial murmurs are suggestive of a light rubbing, grating or friction sound; they are also more superficial and become intensified on pressure of the ear upon the chest.

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4. *Position of the murmur.*—Exocardial murmur, and chiefly the pericardial, often changes its place with the change in the position of the patient, owing to alterations in the relative position of the two roughened surfaces of the pericardium. The rhythm is also variable from day to day or from hour to hour. The endocardial murmurs on the other hand are fixed.

5. *The area or the extent of the surface occupied by the murmur.*—The exocardial (pericardial) murmur is heard at indefinite points over the pericardium. It is sometimes most distinct at the base and sometimes at the apex. It is not propagated to any distance, but often disappears altogether at a little distance from its origin. The endocardial murmurs are propagated in different directions according to the course of any particular blood-current and are best heard at certain definite points.

6. *The condition of the circulation.*—With exocardial (pericardial) murmur, or a to and fro friction murmur, the pulse is usually accelerated: with endocardial (aortic double) murmur, the pulse is of normal frequency, but is jerking, tortuous, visible, and collapsing in character.

7. *Co-existence of fremitus on palpation.*—Well-marked superficial fremitus generally accompanies pericardial friction murmur.

Prognosis.—The prognosis in cases of valvular diseases of the heart must always be a guarded one, for unexpected alterations frequently take place. There is in the museum of the College of Physicians of London the heart of a Fellow of the College who died in the last century at the age of more than eighty years. It exhibits extreme disease of one of the flaps of the aortic valve, and calcification of the coronary arteries. The aortic lesion almost certainly began early in life. But this must be regarded as an almost exceptional case, and it may be laid down as a first principle that valvular disease materially shortens life, and the earlier in life it begins the more disastrous are its consequences. Children born with congenital malformation rarely exceed the age of three years. One reason why valvular disease in childhood is likely to have more serious consequences than the same lesion later on, is that the growth as well as the nutrition of the heart is interfered with. Moreover, the mischief does not remain stationary. A child who gets valvular lesion under the age of five can hardly be expected to attain the age of thirty years. The habits and opportunities of the individual affect his heart, as also all his tissues, and good food, mental and bodily rest, and care, will enable such patients to live much longer than they would under opposite circumstances. In poor persons, obliged to work, valvular lesions soon produce fatal consequences.

In all cases of valvular lesion nature makes compensatory efforts in order to obviate danger. Thus, in aortic stenosis the excentric hypertrophy of the left ventricle is a compensatory change, and hence, a long time may elapse before any marked symptoms arise. These compensatory efforts vary in different cases, according to the extent of the lesion and the individual peculiarities. In persons in robust health the compensatory effort is often great and adequate for a time, even though the lesion be very serious. In other cases the tissues are prone to degeneration or decay, and in them the lesion is extensive, the heart soon degenerates, the compensation is extremely slight, and soon becomes inadequate, and serious consequences speedily follow. The *form* of valvular disease is an important element in prognosis. In *mitral* disease death is usually gradual; in *aortic* regurgitant disease it may be gradual, but is often sudden, and is due to syncope. Cases of mitral obstruction terminate much sooner than those of mitral regurgitation. Of all forms of valvular disease, aortic obstruction may be regarded as the least dangerous to life. Renal complications and lung-disease frequently terminate the lives of persons having any form of valvular disease. It must be borne in mind that various accidents are liable to occur: thus, hemiplegia or infarction of the lung may suddenly cause the case to become very serious. The extent of dropsy is not always to be taken as an index of the danger of the case, as persons with very extensive dropsy frequently recover for a time when given rest and proper treatment; but repeated attacks of faintness, of angina, or of urgent dyspnœa are always of grave import. Persistent albuminuria is, of course, a very serious symptom. Atheroma of the arteries likewise increases the danger.

Treatment.—Valvular affections are incurable; the lesions have a tendency to increase, the secondary effects are hypertrophy and dilatation of the chambers of the heart, and hyperæmia of the lungs. Our objects ought, therefore, to be—1, to prevent further mischief arising; 2, to ward off the more prominent and untoward symptoms; and 3, to prolong life. Nature makes a compensatory effort to overcome the obstacles to the flow of blood, and hypertrophy ensues. We must endeavour to maintain life as long as possible, by preventing the operation of all those causes which lead to increased action of the heart or further distension of the overcharged veins. Dilatation often accompanies hypertrophy, but since it is due to impairment of the muscular strength of the heart, it may be to some extent prevented by attention to diet and hygiene. The patient should as far as possible give up any laborious occupation, and should abstain from sudden efforts of body or mind; fatigue must always be avoided, but moderate exercise in the open air does good. A proper amount of sleep should be obtained, and non-conducting clothes next the skin are advisable. All abuses and excesses should be prohibited. The diet should be nutritious, non-stimulating, and easily digestible, and taken at proper intervals. All articles tending to cause distension of the stomach and bowels should be carefully avoided. Meat, eggs, milk, cocoa, green vegetables, and toasted bread are the most suitable articles of diet. The bowels should be kept open and dyspepsia relieved. Very often, notwithstanding every precaution, the disease becomes more and more apparent. When urgent symptoms arise, absolute rest is far more valuable than any other remedy.

The medicinal treatment of mitral lesions differs in several respects from that of aortic diseases. The treatment of the mitral affections will first be described.

Engorgement and dilatation of the pulmonary vessels are inevitable consequences of mitral disease. They cannot be indefinitely averted nor permanently relieved. If the dyspnœa becomes very urgent, relief may be obtained by general blood-letting, but such a procedure is very apt to render the blood more poor and watery, and increase the tendency to transudation of serum into the subcutaneous areolar tissue and serous cavities. As symptoms of dropsy are very common after loss of blood in these cases, phlebotomy must be avoided as far as practicable. Digitalis is found by experience to be a very efficacious remedy for hyperæmia of the lungs and general venous engorgement. It may be given with much confidence. Its good effects are noticed as regards the cardiac action, the pulse, urine, and dropsy. If the cardiac action be rapid, irregular, or embarrassed, these symptoms generally become much relieved. The frequency and feebleness of the pulse and its irregularity are much improved by this drug. Digitalis is said to render ventricular systole and diastole more prolonged and complete, less frequent and more regular; it also combats unusual irritability of the heart;

hence by digitalis the periods of rest between the contractions become longer, and the blood is driven from the auricle into the ventricle through the contracted passage with sufficient force. From the ventricle it is driven more forcibly and in greater quantity into the aorta. The aortic recoil and the nutrition of the cardiac walls are improved. Digitalis is especially recommended if the pulse be intermittent and also feeble. Under its use the urine increases in quantity if dropsy be present. This diuretic action of digitalis on the kidneys is similar to its action on the heart. The arterioles of the kidneys become dilated, and the flow of blood through the renal arteries is promoted.

Further improvement follows these results. The dyspnœa becomes less, the derangement of the liver is relieved, and if dropsy be present it subsides or temporarily disappears. The action of digitalis is to regulate or readjust the circulatory derangement. In mitral disease there is less than the normal quantity of blood circulating through the aortic system. As a result of the action of digitalis more blood passes into the arteries. The vessels of the glomeruli of the Malpighian capsules receive more blood, and thus suppression of urine is averted. The occurrence of this symptom is prevented if the agent used either dilates the arterioles of the kidney and thus increases the force of the circulation of blood, or alters the structure of the walls of the renal vessels, and thus facilitates the transudation of liquids from them. Good results very often follow the use of three or four-grain doses of carbonate of ammonia, combined with twenty minims of the tincture of squills, thirty minims of the tincture of digitalis, with five grains of tartarated iron three or four times a day. The preparations of iron are very useful in these cases of dropsy, as there are also signs of anæmia. Iron renders the serum of blood more concentrated by increasing the number of red corpuscles and the amount of albumen. It is useful in both mitral and aortic disease. In aortic regurgitant disease digitalis is not indicated. In tricuspid regurgitation, with enlargement of the right ventricle, it must be given with caution. In fatty degeneration it must also be used with caution; it aids in causing contraction of the muscular fibres which are still left healthy. It is contra-indicated in extensive atheroma. In functional palpitation and in bronchitis associated with heart disease it is often useful. In cases of mitral disease some prefer arsenic and antimony to digitalis, and give $\frac{1}{60}$th of a grain of arseniate of antimony two or three times a day. This remedy, although successful in some cases, is not so generally efficacious as digitalis. I often prefer digitaline to the tincture and prescribe $\frac{1}{100}$th of a grain for a dose.

A remedy, viz. *Convallaria majalis* (lily of the valley), the action of which is somewhat similar to that of digitalis, has lately been introduced. Its effects are said to be most striking in cases of mitral insufficiency. It may be given in the form of an aqueous extract (dose ♏v to ♏xv), or the tincture (dose ♏x to ♏xl); an infusion of the flowers (gr. x to ℥vj), in doses of one tablespoonful twice a day, is also recommended. It appears to soothe mental irritability, which is so often a marked feature in cases of heart disease. Its influence on palpitation and dyspnœa is felt at once. M. Germain Sée has investigated the physiological action of aqueous extracts of the whole plant, and has arrived at the following results:—" 1. The *Convallaria majalis* is a most important cardiac medicament. 2. Administered in doses of from one gramme to one and a half grammes per diem, the aqueous extract constantly produces favorable effects on the heart by moderating its action, and often re-establishing its normal rhythm. The heart's action is strengthened, the exaggerated arterial pulsations are regularised, and the respiratory system acquires greater inspiratory power, the difficulty of breathing being moderated, and causing less painful symptoms. 3. It also acts in the most marked manner as a powerful, constant, and valuable diuretic, rendering it peculiarly fitted for the treatment of cardiac dropsy. 4. It is useful in all affections of the heart, there being apparently no contra-indications. It has no injurious effects on the cerebro-spinal system, nor on the digestive organs. It does not accumulate in the system, and its effects speedily pass away. 5. For the above purposes it is superior to digitalis, which very often cannot be exhibited, owing to its injurious action on the appetite and the digestive organs, and to its causing vomiting and pupilar dilatation after more or less prolonged use, effects being often produced diametrically opposed to those sought to be obtained. 6. It is inferior to morphia and iodine in the treatment of cardiac dyspnœa, but the first-named medicament is likely to produce suppression of urine. In conjunction with the aqueous extract, iodide of potassium plays a most important part in the treatment of cardiac asthma. 7. To sum up, the aqueous extract of *Convallaria majalis* surpasses all other remedies in the treatment of cardiac diseases, especially when complicated with dropsy, rendering the administration of other diuretics unnecessary."—With regard to these conclusions, further experience is necessary, in order to determine whether they can be fully justified. There appears, however, sufficient evidence to show that Convallaria is a very important addition to our list of cardiac medicines.

The other symptoms which may arise during the course of heart disease need special attention. These are angina, palpitation, shortness of breath, jaundice, albuminuria, pulmonary apoplexy, &c. The pain of angina may often be relieved by sedative plasters, antispasmodics, and nitrite of amyl. Palpitation and dyspnœa are often relieved by sedatives. To relieve the overloaded venous system purgatives, diaphoretics, diuretics, and chiefly digitalis, are most useful. Shortness of breath and engorgement of the lungs may be relieved by ether, ammonia, camphor, and other stimulants, and by external counter-irritation. Sleeplessness, which is a common and a very distressing symptom, generally yields to the subcutaneous injection of one-sixth of a grain of morphia, and the same remedy will often relieve the dyspnœa. Chloral, bromide of ammonium, and nepenthe, either separately or in combination, are often serviceable in these cases, but their use requires caution.

Treatment of aortic insufficiency.—When this condition exists alone, and compensation is tolerably complete, the treatment is that of the hypertrophy which has become developed. Excitement of all kinds must be avoided, the diet must be of a sufficiently nutritious but non-stimulating character, and the bowels should be kept open by means of purgatives if necessary. Digitalis is seldom indicated, but a few doses are sometimes useful to relieve palpitation and headache. Nitrite of amyl is also useful when these symptoms are troublesome. The application of cold to the region of the heart often checks palpitation, and affords much relief to the patient.

Treatment of aortic obstruction.—This differs in almost all respects from that of insufficiency. The brain is in an anæmic condition, inasmuch as the contractions of the heart are not sufficient to counterbalance the obstruction. Good nutritious food and stimulants are generally required. Digitalis may do good when compensation becomes defective; it does harm if it considerably retards the heart's action. Iron, quinine, and especially nux vomica, are often very useful.

In those cases in which two or more valvular lesions coexist digitalis is the main remedy to be relied on. It is generally useful whenever there are signs of venous engorgement. Convallaria would also appear to be suitable for these cases.

MYOCARDITIS.

Myocarditis is an inflammation or a destructive process of the muscular substance of the heart, the tissue of which becomes flabby and soft, and ultimately disintegrates. It generally occurs from causes which lead to pericarditis or endocarditis. It may appear in spots forming aneurism of the heart. Valvular diseases due to endocarditis and emboli from the lungs entering the coronary arteries sometimes lead to it, and it may also be due to rheumatism, syphilis, and to infectious fevers, as scarlatina, typhus, and pyæmia. The inflammation extends either from the pericardium or from the lining membrane to the substance of the heart; the walls of the left ventricle, especially the apex, suffer more than any other part. In rare cases the entire wall becomes inflamed, and abscesses due to disintegration are found in the substance of the heart.

Morbid appearances.—The changes are found at the apex of the heart and in the walls of the left ventricle. They sometimes exist in the septum, just below the aorta. At first there is discolouration and softening of the heart's substance, which is dark and bluish red; soon after the muscular fibres lose their striated appearance, become soft and greyish, and are less resistant, and subsequently, if no resolution takes place, may break up altogether. Under the microscope, the fibrillæ appear to be converted into a finely granular detritus, with a few fat globules. In advanced cases the substance of the organ becomes infiltrated with serum and pus, or becomes contracted and hardened or cicatrised. This indurated tissue may constitute all that remains of the tissue of the heart. Where the inflamed or degenerated portions yield to the pressure of the blood, aneurism or abscesses may form. These may burst into the pericardium, and lead to pericarditis, or into the cavities of the heart, and lead to embolism and pyæmia.

Symptoms.—Myocarditis can be seldom diagnosed during life. It is generally complicated with endocarditis or pericarditis. In the early stage the action of the heart suddenly becomes weak and irregular, and the pulse is small and quick. There is generally a history of rheumatism, perhaps without physical signs of endocarditis. Myocarditis is indicated if rigors occur, with vomiting and pain in the spleen, or if there are evidences of renal mischief, such as albuminuria or blood in the urine. When degeneration takes place, the heart's action is much depressed; the pulse is very feeble and very irregular and intermittent. There is more or less fever of a typhoid character, and signs of blood-poisoning, followed by collapse. Dropsy and cyanosis are other symptoms likely to be present, especially if the case be complicated with dilatation or valvular disease.

Treatment.—All that can be done is to attempt to relieve the urgent symptoms. In other respects the treatment is that of endocarditis.

Hypertrophy of the Heart.

Hypertrophy signifies an increase in the size and volume of the muscular tissue of the heart, and also of the relative thickness of the walls of its different chambers. Roughly speaking the healthy heart is of the *same size* as a closed fist. The walls of the left ventricle are thicker than those of the right, as it has to do more active work than the other. Hence the right side is to the left as 2 to 5. The natural *weight* of the heart is about 10 oz. in males and 8 in females. The normal thickness is as follows: The left ventricle in males is 5 lines, in females 4½ lines. The right ventricle in males is 2 lines, in females 1⅔ line. The right auricle in males and females 1 line, the left auricle 1½ line. In hypertrophy the left side is generally affected.

Varieties.—Hypertrophy may be *simple*, in which case the muscular parietes become thickened without any increase in the size of the cavity corresponding to it. When the walls become thickened, and the cavity is also larger than natural, the condition is called *excentric* hypertrophy, or hypertrophy with dilatation. This is most common. When the thickness is accompanied with corresponding diminution in the size of the cavity, it is called *concentric* hypertrophy. Although it is said to occur in congenital malformations, this is rarely, if ever, seen. The excentric variety is the commonest, and may occupy the whole heart, or the right or the left side. The simple form is rare, and when it occurs may affect the left side only. It is chiefly met with in cases of Bright's disease, and in constriction of the aortic valve. When the heart is excessively hypertrophied it is placed deeper in the chest, the diaphragm is depressed and the heart lies transversely, the base being to the right and the apex towards the left side. Hypertrophy of the heart is generally compensatory, and thus in organic heart-disease hypertrophy is beneficial.

Pathology and general causes.—Hypertrophy is due to causes which increase the force and frequency of the heart's action. Chief among these are obstructions to the free circulation of blood; forcible contraction of the heart is necessary to overcome these obstacles, and this, as in similar cases in which a muscle is called upon to exert its full power, causes the muscular substance of the organ to increase in bulk. When resistance is met with in the systemic or in the pulmonary circulation, dilatation of the corresponding ventricle is the first result, for the cavity is not completely emptied at each contraction. Hypertrophy (excentric) follows the dilatation. In the case of the *left ventricle*, hypertrophy with dilatation arises from the presence of some impediment in the aortic circulation. The obstructions are of various kinds; among them the principal are *constriction* of the aortic orifice, *insufficiency* of the aortic valves, *atrophy* of the kidney, *degeneration* of the walls of the aorta, and *constrictions* and *aneurysms* of that vessel.

Hypertrophy of the right ventricle may be due—(1) to *engorgement of the pulmonary circulation*, as occurs in mitral lesions; (2) *to destruction of a large number of the pulmonary capillaries*, as in emphysema, atrophy of the lung, and in cases of compression of the lung from any cause; (3) to *valvular lesions* at the orifice of the pulmonary artery. These last are, however, very rarely met with. Both ventricles are liable to become hypertrophied if obstructions exist in both the systemic and the pulmonary circulation.

Hypertrophy of the auricles is liable to occur in cases of constriction of the auriculo-ventricular orifices, and of insufficiency of the tricuspid and mitral valves.

Besides being due to the presence of obstructions, hypertrophy with dilatation of the ventricles may be caused by undue action of the heart. This form of hypertrophy, without valvular lesion or other impediment, is not unfrequently developed as a result of violent and long-continued physical exercise, frequently repeated. Gluttony, abuse of alcohol and of tobacco favour its production. One great cause of cardiac hypertrophy among soldiers is to be found in exertion carried on under unfavorable conditions as regards clothes, weights, and attitudes.

Post-mortem appearances.—There is numerical increase of the muscular fibres, and the heart is increased in bulk; this varies in proportion to the amount of hypertrophy; the heart is also increased in weight. It may weigh from one to two pounds. Where dilatation and hypertrophy are combined, the heart is more or less globular in shape, and the apex is obliterated. If only the left ventricle is hypertrophied, the heart is elongated and conical. When the right side is affected, the heart is generally rounded and increased in breadth, and the right ventricle and apex lie forwards. In enlargement of the right side the apex is displaced to the left, the right border becomes more horizontal, and is also increased in an upward direction. In extreme cases of hypertrophy the walls of the left ventricle are from one to one and a half inches in thickness, those of the right from half an inch to one inch. The muscular walls are of a darker colour, and the tissues very firm and resistant.

Symptoms.—Hypertrophy, when strictly compensatory, is not attended with any serious symptoms. These are due to its effects upon the circulation. It is difficult to state the symptoms separately as other lesions of the heart or great vessels almost always coexist. Thus, cyanosis and dropsy are not caused by hypertrophy, but are due to complications, and such symptoms often mask the effects of pure hypertrophy. Hypertrophy of the left side gives rise to increased aortic circulation, and hypertrophy of the right to increased pulmonic circulation. In hypertrophy of both ventricles we find fulness of the arterial system with partial emptiness of the venous system, and the circulation is accelerated. In hypertrophy of the left ventricle the aortic system is overfilled, the great systemic circulation is accelerated, and the blood in the pulmonic system is reduced. The overfilling in the aortic system is not so great as to cause cyanosis and dropsy by over-distension in the venous circulation. This is due to the fact that the vessels of the lung are imperfectly filled; they offer less resistance to the blood from the right heart, which propels it freely, and the engorgement of the vena cava therefore subsides. When the hypertrophy is due to aortic disease, the pulse is either small and compressible, or hard and full, the brain is congested, and there is a tendency to cardiac degeneration. In hypertrophy of the right ventricle the pulmonary system is over-filled, and the great systemic circulation contains less blood. The circulation, however, is accelerated. The distended pulmonary system sends more blood to the left heart, and the right auricle receives a less quantity from the venæ cavæ. When due to mitral disease the epigastric pulsation is a prominent feature, and the pulmonary arteries are tense and apt to become dilated and degenerated, and there is congestion of the lungs. The distension of the arteries due to excentric hypertrophy may also lead to their degeneration and rupture.

Excentric hypertrophy of the whole heart often occurs without any complication. In such patients the pulse is full and strong, the carotids pulsate visibly, and the great arteries throb. The patient has a red face and prominent and glistening eyes. The breathing is not affected at first, but after a time as the hypertrophy increases, the heart presses the diaphragm downwards, and pushes the lung to one side. In such cases, there is a sensation of fulness in the chest and of pressure in the epigastrium, and often more or less dyspnœa. Palpitation of the heart is common. The patients often complain of a strong heaving impulse, sufficient to jar the chest like the blow of a hammer. All these symptoms generally cause little or no inconvenience, except at times, and particularly when the patient is excited. The symptoms of active hyperæmia are most manifest in those organs whose vessels possess but feeble power of resistance, and which are liable to become affected whenever the force of the circulation is increased. The most sensitive organs in this respect are the brain and bronchial tubes. In the case of the brain, any undue exertion or the use of stimulating drink, gives rise to headache, dizziness, ringing in the ears, spots before the eyes, and other symptoms of cerebral congestion. The fluxion to the bronchial arteries occasions embarrassed breathing and cough, owing to the swelling of the bronchial mucous membrane. There are also symptoms of bronchial asthma, which often recur periodically once or twice in every month. They are generally relieved by cathartics, the action of which lessens the blood-pressure upon the abdominal vessels.

Cerebral apoplexy, occurring in young persons, is often attributable to hyperæmia of the cerebral vessels, caused by the excessive action of the hypertrophied heart. The vessels of the brain are thin and weak and give way under increase of blood pressure. Atheroma is also common in cases of hypertrophied heart. The pulmonary artery, which otherwise is rarely atheromatous, is often thus affected in cases of hypertrophy of the right ventricle. Other symptoms may be noticed and are due to the degeneration of the heart which often follows hypertrophy. These are venous obstruction, cyanosis, dropsy, &c.

Excentric hypertrophy of the left side of the heart may occur without any complication. The symptoms are those of overfilling of the aortic system; the venous system is moderately full and the circulation is accelerated. The pulmonary system is less full, but the evil effects of this change are neutralized by the acceleration of the circulation. Palpitation is a frequent symptom. The pulse is full and strong, the respiration is not interfered with, and the other functions go on regularly. This affection often ends in cerebral apoplexy. Hypertrophy of the right ventricle, without any complication, is extremely rare, but this portion of the heart is often enlarged in cases of lesion of the valves and of derangement of the pulmonary circulation.

Physical signs.—Inspection.—When the heart is increased in size the position of the apex-beat is altered. In hypertrophy and dilatation of the *left ventricle* the impulse may be noticed in the sixth, seventh, or even eighth intercostal space. The increase in size takes place mainly in the long diameter of the ventricle. When the *right ventricle* is affected, the breadth of the heart is principally increased; the impulse is moved towards the right side. The force of the heart's impulse is much increased in hypertrophy. When this latter condition ceases to increase, and dilatation becomes the more prominent feature, the impulse becomes more feeble. The impulse is stronger in hypertrophy of the left than of the right ventricle. When the left ventricle is much increased in size, the greater part of the left side of the thorax is elevated with each contraction and falls back during the diastole. In cases of excessive excentric hypertrophy, the præcordial region is bulged out, especially in children whose chest walls are yielding. *Palpation.*—In the healthy state, with each systole a shock or concussion known as impulse can be felt over a limited spot in the intercostal spaces, corresponding to the apex of the heart. With the systole the heart is depressed and pressed against the walls of the chest. In its descent it is also elongated; the extension is downwards and outwards. In persons who have wide intercostal spaces, the impulse is most visible, and the apex points outwards. In individuals with narrow spaces, instead of an impulse, we feel a circumscribed jar or shock upon the ribs or intercostal spaces. When the heart is excited, the shock, instead of being circumscribed, may be felt over a large area of the chest and also in the epigastrium. In hypertrophy the impulse is persistently large and heaving, and if the head of the listener be placed over the patient's chest the shock will be heaving and intense, and the head of the listener and the chest walls will be lifted during the systole, and sink with the diastole. Hypertrophy is indicated if the breadth of the impulse within the fifth intercostal space amounts to more than one inch and which thus passes beyond the mammillary line to the left or the parasternal line to the right. In hypertrophy of the left ventricle, the heaving impulse is most distinct at the apex, and then spreads from above downwards. In hypertrophy of the right side the impulse spreads transversely and may be felt between the normal position of the apex and the edge of the sternum.

Percussion.—The area of cardiac dulness is increased, its extension varying with the part of the heart affected. In hypertrophy of the left ventricle the dulness extends downwards. In general hypertrophy it is increased longitudinally as well as transversely. In enlargement of the right ventricle the cardiac dulness is increased in breadth.

Auscultation.—The sounds are normal in simple hypertrophy; they are, however, intensified owing to the auriculo-ventricular valves being more exposed to friction and thrown into violent vibrations. The pulmonary artery and the aorta being also fuller, the valves recoil more actively, and the second sound is intensified.

Diagnosis.—When simple hypertrophy is complicated with emphysema of the lung, the lung covers the heart, and the physical signs are not diagnostic, the increased cardiac impulse may not be felt; on the contrary, the impulse may be imperceptible. With this complication the dulness is apparently diminished, and the sounds are muffled and fall very feebly upon the ear. Besides the physical signs the symptoms which relate to derangement of circulation are also apt to be overlooked in such cases. The diagnosis stimulating drink, gives rise to headache, dizziness, ringing in the ears, spots before the eyes, and other symptoms of cerebral congestion. The fluxion to the bronchial arteries occasions embarrassed breathing and cough, owing to the swelling of the bronchial mucous membrane. There are also symptoms of bronchial asthma, which often recur periodically once or twice in every month. They are generally relieved by cathartics, the action of which lessens the blood-pressure upon the abdominal vessels.

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Percussion.—The area of cardiac dulness is increased, its extension varying with the part of the heart affected. In hypertrophy of the left ventricle the dulness extends downwards. In general hypertrophy it is increased longitudinally as well as transversely. In enlargement of the right ventricle the cardiac dulness is increased in breadth.

Auscultation.—The sounds are normal in simple hypertrophy; they are, however, intensified owing to the auriculo-ventricular valves being more exposed to friction and thrown into violent vibrations. The pulmonary artery and the aorta being also fuller, the valves recoil more actively, and the second sound is intensified.

Diagnosis.—When simple hypertrophy is complicated with emphysema of the lung, the lung covers the heart, and the physical signs are not diagnostic, the increased cardiac impulse may not be felt; on the contrary, the impulse may be imperceptible. With this complication the dulness is apparently diminished, and the sounds are muffled and fall very feebly upon the ear. Besides the physical signs the symptoms which relate to derangement of circulation are also apt to be overlooked in such cases. The diagnosis must be based upon the combination of the symptoms with the physical signs. The principal diagnostic signs of hypertrophy of the left ventricle are extension of the cardiac dulness longitudinally, intensification of the sounds, a full pulse, visible pulsation in the carotids, increased impulse, and depression of the apex beat. When the right ventricle is affected there are extension of the cardiac dulness laterally, intensification of the sounds, increased impulse, and displacement of the apex beat towards the right side. Intensification of the second pulmonary sound is an important indication of hypertrophy of the right ventricle.

Prognosis.—Simple hypertrophy is the least dangerous. As a complication hypertrophy is often compensatory, and therefore is favorable in valvular diseases of the heart. Danger arises from hypertrophy when attended with dilatation, and from the degenerative changes which the hypertrophied heart is apt to undergo. In simple hypertrophy the main dangers are due to the liability to cerebral apoplexy and pulmonary hæmorrhagic effusion, but these consequences may often be prevented by proper care and treatment.

Treatment.—The disease when once established can never be eradicated. The treatment, therefore, consists in taking measures for the relief of urgent symptoms, and for the prevention of the further spread of the existing mischief. All those causes which lead to increased action of the heart must be scrupulously avoided. Thus the free use of stimulating food or drinks and undue bodily exercise should be prohibited. Mental excitement, which often leads to increased activity of the heart, should be carefully avoided. Great care should be taken to prevent excessive flow of blood to the brain, as its vessels being weak and less able to resist the extra force than those of other organs, readily give way, and apoplexy is the result. The disease is common among drunkards and gluttons. In these cases dietetic management is more necessary than any other treatment. The next important point in the treatment of hypertrophy of the heart is to remove any obstruction to the blood in the abdominal aorta. For this purpose the bowels must be kept thoroughly and regularly relieved. Bloodletting as a means of diminishing the force of the circulation is not useful in cases of hypertrophy of the heart. Such depleting measures tend to make the blood poor, and also aid in producing degeneration of the heart. They are useful only when apoplexy is threatened. Digitalis should be used with caution. In all cases where the heart's action is increased digitalis is useless. It is, however, extremely useful in cases of cyanosis, dropsy, and hepatic engorgement, due to complicated hypertrophy. In these conditions the action of the heart is weakened. Convallaria would appear to be indicated for many cases of hypertrophy (see p. 426). The application of a cold compress over the region of the heart, is worthy of trial; it has been found to give great relief to many of the symptoms of hypertrophy.

DILATATION OF THE HEART.

Dilatation of the heart means an abnormal increase of its capacity. It occurs in cases where the cavities are enlarged and the contractile power of the organ is diminished.

Varieties.—These are: (1) The cavity is dilated and the wall of normal thickness, or comparatively too thin; (2) the cavity dilated and the wall positively thinner than normal; (3) the cavity dilated, but the wall thickened through spurious hypertrophy or degeneration.

In dilatation the auricles are most often affected, then the ventricles, and the right ventricle more frequently than the left. The explanation is easy. The blood enters the heart by the veins and under a moderate pressure. The walls of the right auricle and ventricle are only one and two lines respectively in thickness, and hence more apt to become dilated than the left ventricle, whose thickness is about five lines.

Causes.—The causes of dilatation are chiefly three: (1) Unnatural and severe internal pressure during the diastole; (2) diseases of the substance leading to loss of tone of the cardiac walls; (3) degeneration of the substance of a hypertrophied heart. A mere impediment to proper contraction of the heart cannot cause dilatation, because as soon as the contractile force of the heart is less than the resistance of its contents the circulation will stop. In the case of disease of the pulmonary artery just at its root, or of obstruction in the lungs, dilatation is produced. The result of the obstacle during the systole is that the right ventricle is incompletely emptied of its contents. During diastole the gush of blood finds the ventricle nearly full instead of being empty. Blood continues to pour in so long as the pressure upon the blood in the venæ cavæ exceeds the resisting power of the walls of the cavity, and dilatation is thus produced. In aortic regurgitation, the left ventricle is considerably dilated. The result of the regurgitation is that during the diastole blood passes into the ventricle from the aorta; the cardiac wall is relaxed and yields to the great pressure of the blood. In aortic constriction there is very slight dilatation. In cases where constriction and insufficiency coexist, the dilatation is extreme. In mitral regurgitation a less degree of dilatation occurs. This is due to the fact that during ventricular systole, owing to the insuffioccurs in aged persons it has in all probability resulted from endarteritis deformans. In these cases, besides cyanosis and dropsy, the superficial arteries are tortuous, hard to the feel, and pulsate visibly.

Physical signs.—On *inspection*, as a general rule, the visible pulsation is extremely faint, or even imperceptible; sometimes it is strong, but never heaving in character. Where dilatation is considerable the apex beat is displaced in a direction downwards and outwards.

Percussion.—The præcordial dulness is increased in a degree varying with the seat and extent of dilatation. When the heart is covered by the lungs, as in emphysema, this sign is often wanting.

Auscultation.—The sounds of the heart are feeble, owing to the languid vibrations of the auriculo-ventricular valves and of the arterial walls. In cases of anæmia the first sound is prolonged and often reduplicated. In cases associated with degeneration the sounds are muffled owing to the less decided tension of the valves. Where the valves are imperfectly stretched, owing to degeneration, the vibrations are irregular, and murmurs may be heard. These murmurs are similar to those which are often heard in anæmia, in cases of defective innervation of the heart, and in febrile diseases.

Treatment.—In every case of dilatation there is a tendency for the heart to become flaccid. Efforts must be directed towards retarding the advent of this condition. Everything tending to make the action of the heart more difficult should be avoided. Light but nutritious diet, *e.g.* soups, eggs, and milk, is very desirable in such cases. If signs of anæmia appear iron is indicated. Exertion must be forbidden, and stimulants allowed only in small quantities, and well diluted. If symptoms of cyanosis begin to appear, digitalis alone, or in combination with iron, is the best remedy, as it strengthens the contractile power of the heart, and thus helps to remove cyanosis and effusion. Convallaria is indicated in cases of dilatation; it increases the energy of the contractions. Arsenic, one-thirtieth of a grain in a pill, may also be given every morning and evening with the view of strengthening the heart. In every case the action of the bowels must be properly regulated, and congestion of the liver should be prevented as far as possible.

ATROPHY OF THE HEART.

The condition may be either congenital or acquired. As a congenital affection it is met with more often in females than in males. Acquired atrophy may be produced by all those causes which diminish the normal supply of nutritive material, or 'lead to abnormal consumption of the muscular system in general. Thus cardiac atrophy sometimes occurs in tubercular consumption, in cancerous cachexia, and as a consequence of old age. It is also met with as a result of prolonged typhus. Other causes of cardiac atrophy are undue pressure, as results from pericardial effusion or large accumulation of fat upon the organ, and contraction of the coronary arteries, which acts by interfering with the nutrition of the heart.

Anatomical appearances.—In congenital cases the heart may be very small, the walls are thin, the cavities small, and valves delicate. In acquired atrophy, besides smallness, there is absence of fat upon the organ, its place being taken by serous infiltration. The pericardium is thick, and often contains fluid; the coronary arteries are tortuous. On opening the heart the endocardium is clouded, valves swollen, the substance pale and less firm. Acquired atrophy is almost always concentric; it is very rarely simple in character.

Symptoms.—In congenital atrophy the symptoms most prominently marked are frequent attacks of fainting and palpitation of the heart. The patient is chlorotic, and presents signs of anæmia and defective nutrition. In acquired atrophy there are often symptoms of marasmus or wasting of the whole system. In such cases very little blood is propelled onwards; the arteries are incompletely filled, and there is engorgement in the veins. Dropsy with well-marked cyanosis is rare in these cases. Where cardiac atrophy is due to external pressure or to diminished calibre of the coronary arteries, the heart is unable to maintain the circulation without very great exertion, and the patient complains of frequent palpitation. There is also dyspnœa due to emptiness of the arteries, overfilling of the veins and retardation of the current of the blood, and the venous character of that fluid. Cyanosis and dropsy appear in advanced cases. Fatty degeneration of the substance of the heart is common under these circumstances.

Physical signs.—The impulse of the heart is very feeble or even imperceptible. The pulse is extremely small. Dulness in the præcordial region is lessened owing to the diminished size of the heart. The vacuum so produced is filled up by extension of the lung (emphysema), or by pericardial effusion. In the latter case the cardiac dulness is normal. On auscultation the heart sounds are feeble or indistinct; sometimes they are muffled. Occasionally murmurs may be heard.

Treatment.—Very little can be done in the way of treatment, but the urgent symptoms may demand interference. The general health must be improved and undue exertion avoided. The patient should be supplied with a good nutritious diet, and wine may be given in moderation. A course of iron is likely to be serviceable. Palpitation may sometimes be relieved by a belladonna plaster or belladonna liniment applied to the præcordial region.

ANEURYSM OF THE HEART.

It is a pouch or sac formed in the wall of the heart, and communicating with one or more of its cavities. In aneurysm of the heart a portion of the texture has become weak; its resisting power against the pressure of the blood is diminished. At first a simple depression is formed, and this gradually extends through the cardiac wall towards the external surface, where a sac is developed. Some writers describe, as *acute aneurysm*, a sac produced by rupture of the endocardium and escape of blood into the muscular tissue, while chronic aneurysm is the result of the giving way of a degenerated portion of the cardiac wall.

Causes.—Age: It is rare before fifteen, but may occur at any subsequent period. *Sex:* Males are more subject to it than females. The chief exciting causes are three: 1. Acute inflammation of the endocardium and of the substance of the heart, leading to softening or ulceration. Chronic inflammation sometimes gives rise to development of fibroid tissue (cirrhosis). This tissue or local thickening, being less resistant and less elastic, is more and more stretched with each contraction of the heart till the affected portion yields and is pushed outwards, forming a pouch. 2. Syphilitic or other growths. These are liable to undergo a process of softening. 3. Fatty degeneration. This degeneration sometimes results in a spot of softened tissue, which yields to each contraction of the heart. In cases of fatty degeneration of the heart partial rupture sometimes takes place in the muscular wall, and a clot of blood collects in the rent. The clot then undergoes changes, and a cyst results, which ultimately communicates with one of the cavities of the heart. Of all the causes chronic inflammation or fibroid change in the wall is the most common. Aneurysm as a result of ulceration or cardiac abscess is extremely rare.

Post-mortem appearances.—In cases of aneurysm of the heart adhesions generally exist between the dilated portion and the pericardium, and the heart is usually enlarged and altered in shape. With regard to the form of the sac or pouch, this may be rounded, or conical, or elongated.

On cutting open the heart a depression or an opening is found in the wall of the ventricle or in the septum. The size of the sac varies from that of a small bean to that of a large orange. The opening into the sac varies in size from a pin's head to a diameter of two inches. The neck may be hard and cartilaginous, and either smooth or jagged. The wall may be as thin as parchment, or thick and much altered in texture. It may be composed of endocardium, with or without muscular structure, fibroid tissue, and pericardium. The cavity may be smooth and lined by a membrane (the endocardium), or may be ragged and formed of muscular fibres with blood extravasated between them. The contents may be blood-clots or layers of fibrin, the outermost layer being organised and adherent to the wall of the growth. The left ventricle of the heart is by far the most frequent seat, and the apex is the part most often affected. In a few cases the aneurysm has been found in the right ventricle and in the septum.

Symptoms.—Aneurysm of the heart can hardly be detected during life. The symptoms are indefinite, and the diagnosis can hardly be made. The symptoms, indeed, are the same as those of other heart diseases, viz.: 1. Pain. 2. Dyspnœa. 3. Lividity of the surface. 4. Palpitation. 5. Irregularity of pulse. Cardiac aneurysm may be suspected in a case where there is grave cardiac disorder associated with extension of cardiac dulness to the left and downwards below the apex beat, and a feeble impulse.

Termination.—Death is the usual end, and may result from disturbance of the heart's action, or may be due to the aneurysm opening into the pericardium, or inwards into another cavity of the heart.

Treatment.—There is nothing special to be done. The treatment is the same as that adopted for other grave cardiac disorders. The urgent symptoms should be combated.

Degeneration of the Substance of the Heart.

1. A flabby or abnormally soft and relaxed heart is not unfrequently seen post-mortem in typhus, syphilis, septicæmia, and puerperal fever. There is in some cases no important alteration of structure, but in others the heart presents evidences of granular or fatty or even waxy degeneration of its muscular tissue.

2. *Fatty heart.*—This occurs in two forms. In the first there is an increased deposit of normal fat upon the surface of the heart.

The accumulation of fat occurs in general obesity, usually in middle or advanced age, and in drunkards. It is also observed to exist in some forms of cachexia. In such cases there is a layer of fat about half an inch thick, covering the heart, surrounding the coronary arteries, and occupying the sulcus between the two chambers. Owing to the pressure of this deposit the subjacent muscle often becomes atrophied; in some cases it remains normal. In the second form there is fatty metamorphosis of the tissue. The fibrillæ are converted into fat-granules, which gradually fill the entire sarcolemma, and form, when combined, large drops. The substance of the heart is pale yellow, and tears readily. This change is sometimes a consequence of defective nutrition, as in cancer, Bright's disease, &c. It is accompanied by signs of marasmus, arcus senilis, and fatty degeneration of arteries. Ossification of the coronary arteries, pressure of pericardial effusion, and even fatty deposit upon the surface of the heart are other causes of fatty degeneration. It may follow valvular disease with excentric hypertrophy.

3. *Amyloid degeneration.*—It sometimes occurs in cases of hypertrophy of the right side of the heart. The walls are rigid, and, when cut, the surface resembles a piece of bacon. It also gives the amyloid reaction with iodine.

Symptoms.—Degeneration is apt to cause dilatation and its consequences. In advanced cases of typhus, septicæmia, or puerperal fever, the heart sometimes becomes relaxed, the impulse is diminished, and the first sound becomes almost or quite inaudible. If recovery takes place dilatation may follow. In such cases the pulse becomes very feeble, and there is increased area of cardiac dulness. There is shortness of breath on exertion, and there may be attacks resembling angina. In obese subjects deposit of fat upon the heart often leads to shortness of breath and other symptoms of cardiac atrophy. Fatty metamorphosis of the heart occasions dilatation, and hence we find symptoms referable to disturbance of the circulation. Imperfect supply of blood to the brain; feeble impulse; slow, easily compressible, and feeble pulse; a tendency to faintness and giddiness, are the ordinary symptoms. In amyloid degeneration of the substance of the heart similar disease of the liver, kidneys, or spleen generally coexists. Degeneration of the heart is one of the causes of sudden death.

Physical signs.—Enfeeblement of the impulse and sounds, increase of cardiac dulness, and a small and slow pulse, are the principal signs of fatty degeneration of the muscular tissue of the heart.

Prognosis.—Very unfavorable in cases of fatty degeneration.

Treatment.—In cases of debility with marked signs of cardiac weakness, following acute diseases, efforts must be directed towards improving the nutrition. Stimulants and tonics are necessary in such cases. In obese persons, who have a deposit of fat on the heart, walking exercise short of fatigue should be recommended. Saline purgatives and alkalies may be tried from time to time. In cases of fatty degeneration good food, stimulants, and tonics are indicated. Undue exertion of every kind should be avoided, but the patient should, when the weather permits, pass as much time as possible in the open air.

RUPTURE OR LACERATION OF THE HEART.

Rupture may follow external injuries, and causes acting from within, as myocarditis, aneurysm, and abscess. Rupture due to internal causes is described as spontaneous laceration. Either the walls of the heart or the valves may be the seat of the lesion. Rupture of the walls, except as a result of accident or injury, never takes place in a healthy heart. It occurs, however, in various diseased conditions, such as fatty degeneration, ulceration, atrophied condition, simple softening, abscess and hæmorrhagic effusion into the walls. Fatty degeneration is by far the most common cause.

The majority of the patients are over sixty years of age. In most cases the rupture of the diseased heart occurs during mental or physical excitement, but it may take place when the patient is at rest.

Morbid anatomy.—Seat.—Its most common seat is the floor of an aneurysm, and generally in the left ventricle, the lesion being in the anterior wall. The rupture may be complete, and the wall may be perforated, or it may be incomplete. Sometimes there is more than one rent. In some cases, the opening hardly admits of a probe; in others, it is two or three inches in length. In incomplete cases rupture may be either external or internal, or only in the substance of the walls. In cases of fatty degeneration the edges of the rupture are irregular and ragged; sometimes ecchymosis is found in the vicinity of the rent. When the rupture is complete effusion is found in the pericardial cavity. It may be partly serum and partly coagulated blood; and it may be so great that the heart is compressed, so that when opened it is empty, flattened, and wrinkled.

Pathology.—Rupture of the heart is in most cases the result of a strain or pressure acting upon the muscular walls. The walls are soft or weak from degeneration or other causes before rupture takes place. When the walls are very thin they may give way under ordinary muscular pressure or contraction of the healthy fibres.

Where the walls are diseased but thick, the outer surface being strained over the contents, may give way and the rupture extend from without inwards. Rupture commonly occurs in the left side. This is due to the greater and more powerful action of the left ventricle as compared with the right. The fact that fatty degeneration is more common on the left than the right side also accounts for the greater frequency of the lesion in the former part.

Symptoms.—Rupture of the heart invariably leads to death. The symptoms are of two kinds, viz. premonitory and those which occur when the rupture takes place. The premonitory symptoms refer to degeneration or diseased condition of the heart, and consist of dyspnœa, palpitation, restlessness, irregular pulse, and faintness. In a majority of cases there are no premonitory symptoms. In a few recorded cases the symptoms were very slight; in a few others very severe. At the time of the accident, when the patient can describe his symptoms, there is intense pain in the præcordia, a feeling of something having given way, faintness, gasping for breath, restlessness and also rapid and irregular pulse, cold skin, and sometimes vomiting and various nervous symptoms. The patient usually dies in a few minutes. In a few cases the patient rallies to some extent, and there is an intermission in the progress of the symptoms. There is more or less anguish, passing into extreme collapse and followed at the end of some hours by death.

Physical signs.—These are more or less increase of præcordial dulness and diminished impulse. The sounds are muffled, distant, or imperfect, the pulse is weak and intermittent.

When the rupture is in the septum death takes place slowly. The course is always fatal, but when the rupture is slight the patient may survive for some hours. The difference in the progress depends upon the condition of the heart, the seat of the lesion, and the rapidity with which the laceration becomes extended. When a small area of the cardiac wall gives way the blood may pass very gradually through the opening and some time may elapse before fatal symptoms appear. One case has been recorded of supposed cure of spontaneous rupture. The patient, a woman, died after fourteen years' suffering with pain about the heart, and rupture of the ventricle was found on examination. A cicatrix was observed to the left side of the recent rupture, half an inch in extent in every direction, in which the new matter was evidently different from the natural structure of the heart.

Treatment.—Nothing can be done beyond relieving the suffering by means of sedatives. If the course be prolonged rest must be enjoined and the patient kept in the horizontal position.

FIBRINOUS DEPOSIT IN THE HEART.

The deposit of fibrin from the blood in cavities of the heart is of frequent occurrence. The clot is most often found in the right side. It is more or less red owing to admixture of blood-corpuscles, or it may be colourless or yellow, and consisting entirely of fibrin. The clots are either loose or firmly adherent among the trabeculæ, between which there are often branches, offshoots from a main clot. They are often prolonged into the main arteries. These coagula are formed either shortly before or after death. If formed before death, and if the patient be young or the struggle during the period of dissolution great, the clot is large and firmly adherent and light in colour.

Cause.—Fibrinous coagula are most commonly met with in diseases in which the fibrin of the blood is considerably increased. Thus they are often found in pneumonia. They are also common in endocarditis, in cardiac aneurysm, and valvular diseases. In these cases the deposit is formed on roughened surfaces. When the clots are large and of old standing they often contain yellowish cheesy material. In other cases they resemble small sacs with thin walls and semi-purulent contents. Those clots which form some time before death are doubtless due to the feeble manner in which the heart has been contracting. They are found especially in subjects debilitated from any cause for a long period before death. Relaxation of the cardiac walls favours the stagnation of the blood.

With regard to symptoms, clots may doubtless produce murmurs, but these cannot be traced to their cause in such cases. Signs of obstructed circulation always precede the formation of coagula.

MORBID GROWTHS IN THE HEART.

Morbid growths may affect the heart or pericardium, or both at the same time. Those found in the heart are tubercles, syphilitic deposits, cancer, and parasites. All these are extremely rare.

Acute miliary tubercles and yellow cheesy nodules are found occasionally embedded in the muscular walls. It cannot be said that they give rise to any definite symptoms; but the pericardium, lungs, intestines, and other organs are generally affected at the same time. Tubercular deposit is not the cause of all the yellow cheesy nodules which are found in the substance of the heart.

Syphilitic lesions of the heart take the forms of inflammatory induration of the muscular substance and of gummatous deposits. The two conditions may coexist. In a very marked case recently recorded the patient, a woman, aged 27, had suffered from syphilis for about three years, but was apparently in good health until the day before her death, when she had an attack of colic and dyspnœa. She died in a state of asphyxia. On post-mortem examination signs of endocarditis were found in both ventricles, but especially in the left, the muscular structure of which, however, was almost normal. The wall of the right ventricle and the inter-ventricular septum were much changed. The former presented scarcely any trace of muscular tissue, having been converted into a grey fibrous layer of a firm consistence, and creaking under the scalpel, and exhibiting on section small whitish masses as large as lentils, which contrasted with the grey semi-transparent tissue in which they were embedded. The septum contained similar white masses. The only other lesions referable to syphilis, viz. small gummata and changes in the coats of the vessels, were found in the kidneys. Some pathologists believe that the two processes, the diffuse interstitial myocarditis and the gummatous formations, are both the results of syphilis, and that they may occur independently of each other. Other pathologists regard the interstitial inflammation as due to the presence of the gummatous nodules. The former opinion would appear to be correct, inasmuch as in a few cases interstitial myocarditis has been found to exist without any gummatous formations. In the case just described there were no marked symptoms of any heart affection beyond slight difficulty of breathing and palpitation on active exertion.

Cancer of the heart is very rare as a primary disorder; it is more commonly secondary to cancerous growths elsewhere, or results from extension from the mediastinum or pericardium. It occurs in the nodular and in the infiltrated forms, and is generally of the encephaloid or melanotic varieties. Cancerous destruction of the aortic valves has been observed; nodules have also been found under the endocardium and pericardium, without actually implicating the heart's fibres. Endocarditis, pericarditis, and hypertrophy have been noticed to coexist with cancer. Its occurrence is more common in males than in females, and the disease has been met with in patients of all ages. Any symptoms that manifest themselves are those of grave cardiac lesion, such as dyspnœa, sudden and severe præcordial pain, emaciation, anasarca, &c. Physical signs may be entirely wanting.

Parasites.—Echinococci are very rare in England, but in Australia, where every form of hydatid disease is very common, the number of cases of hydatid of the heart is proportionately increased. The cysts are embedded in the substance of the muscular walls. They may lead to interference with the cardiac action, or to symptoms of suppuration, to pericarditis from rupture of the cyst, or to embolism when the rupture takes place into the cavities of the heart. Cysticerci have also been met with in the muscular tissue of the heart. The existence of these parasites cannot be diagnosed during life. Symptoms of cardiac mischief may or may not have been manifested before death.

DISEASES OF THE CORONARY ARTERIES.

The chief of these diseases are (1) atheroma and calcification, (2) aneurysm, and (3) syphilitic disease.

Atheroma is a common sequel of a similar condition in the root of the aorta. It may exist on one side, or may attack both vessels. When it exists it invariably leads to fatty degeneration or fibroid change in the corresponding portion of the heart which it nourishes.

Aneurysm.—This condition is extremely rare; it is generally preceded by atheroma or calcification of the coats of the arteries, conditions usually occurring only at an advanced age.

The atheromatous and calcareous changes at the root of the aorta may lead to occlusion of the arteries by a partially detached calcareous plate.

Syphilitic disease is rarely recognised. The condition of the artery closely resembles atheroma, and the history of syphilis is the only guide.

Symptoms.—There are no particular symptoms indicative of these changes. In cases of atheroma the symptoms are due to consecutive changes in the substance of the heart. Angina pectoris is not necessarily due to disease of the coronary arteries. Aneurysm cannot be detected during life. When it exists it usually leads to death by hæmorrhage into the pericardium. Rupture of the left coronary artery close to the aorta has been observed.

CONGENITAL MALFORMATIONS OF THE HEART AND GREAT VESSELS.

The chief congenital malformations are due either to arrest of development, or to inflammation of the endocardium or of the myocardium during intra-uterine life. In the first category comes incompleteness of the septa between the auricles and ventricles respectively. There may thus be (1), two cavities (one auricle and one ventricle) instead of four; (2) three cavities, viz. two auricles and one ventricle or deficiency of a part of the ventricular septum; (3) four cavities, but imperfect septa between auricles and ventricles. Other changes noticed are: (4) permanent patency of the foramen ovale, the extremities. In extreme cases, where symptoms of imperfect decarbonization are prominently marked, galvanism and artificial respiration may be tried.

DISPLACEMENTS OF THE HEART.

Malpositions of the heart are of two kinds—congenital and acquired. The misplacements belonging to the first category may be either within the thorax or external to it. Within the thorax the heart is sometimes found on the right side (dexiocardia), and in such cases the organ may be either perfectly or imperfectly formed. In another kind of internal misplacement the heart is situated in the middle of the thorax. Of the external misplacements (ectopia cordis), the most common is that in which a portion of the sternum is deficient and the heart protrudes from the chest. Other changes have been noticed in the position of the heart. Thus, the organ has been found in the abdomen, and also high up in the root of the neck. All these displacements are compatible with life, provided that the heart is perfectly developed.

In the second category are contained those displacements of the heart which are the results of disease in other organs. Thus, the heart may be (*a*) displaced to either side, (*b*) may be raised above its natural level, or (*c*) may be depressed below it.

Lateral displacement is more readily detected when it occurs towards the right side, and the heart is then generally depressed at the same time. When displaced towards the left the heart is also pushed backwards and upwards. On the right side the organ may pulsate between the fifth and seventh ribs, to the right of the sternum; on the left side it may be pushed almost under the axilla. Pleuritic effusions and hydro-pneumothorax are the principal causes of lateral displacements. Hæmothorax is rarely sufficient, and hydrothorax, being generally double, does not displace the heart. Aneurysms and other tumours, hypertrophy, and emphysema of one lung, are occasional causes of cardiac displacement. The heart is occasionally pushed forwards by intrathoracic tumours. Certain conditions exercise *traction* upon the heart, and thus cause displacement in a lateral direction. Causes of this kind are, rapid absorption of pleuritic effusion, absorption of consolidation, with marked contraction of the substance of the lung, atrophy, and great diminution of bulk from tuberculous disease of the lung.

Elevation of the heart above its natural level is common in cases of ascites and abdominal tumours. In these affections the impulse may be raised to the second intercostal space. Gaseous distension of the stomach and intestines is another cause of temporary upward displacement. Atrophy of the substance of the left lung, at the apex of the organ, and enlargement of the liver, are occasional causes of displacement upwards of the heart.

Displacement downwards is generally due to double emphysema; it may also occur as a result of tumours; it is rarely seen in pure bronchitis and in hydrothorax. In this form the organ is below its proper level, and also pushed towards the median line; the impulse is most decided between the ensiform cartilage and the false ribs on the left side.

In every case of displacement the free or ventricular portion of the heart moves on its base as on a pivot. Affections of the pericardium, and chiefly hydro-pericardium, act mostly by compressing the heart, and preventing its efficient action. When the cavity of the pericardium contains fluid it enlarges in all directions, and chiefly upwards along the ascending aorta or the pulmonary artery. The effusion also pushes the diaphragm downwards and the lungs to each side. When the effusion is very great the heart is pushed backwards or away from the chest walls.

The *symptoms* of displacement of the heart vary with the cause which has produced it. When the displacement has taken place gradually, as in phthisis, there will be no special symptoms. When the displacement is due to pressure distressing symptoms are often rapidly developed. The principal of these are dyspnœa, palpitation, a sense of distress or pain in the chest, irregular and feeble pulse, &c.

Treatment.—When the displacement is the result of disease endeavours must be made to remove the cause or lessen the severity of its operation. When this indication cannot be fulfilled the symptoms must be relieved by appropriate remedies. When pleuritic effusion, ascites, or ovarian dropsy is the cause of the displacement, and the symptoms are urgent, at least temporary relief may be obtained by drawing off the fluid.

NERVOUS AFFECTIONS OF THE HEART—PALPITATION OF THE HEART.

Palpitation is a nervous affection in which the movements of the heart are involved. The term includes a class of symptoms which have reference to the forcible and rapid action of the heart, to suddenness of impulse, and to some irregularity or intermission. There is no change in the structure of the heart, but the symptoms are due to a perverted state of its innervation. Like other neurotic diseases, it is characterised by paroxysms and free intervals.

Causes.—Sudden or violent mental and physical excitement, abuse of spirituous liquors, gluttony, indigestion, derangements of the nervous system, as by strong tea or tobacco; changes in the blood, as in chronic liver disease, gout and Bright's disease are its most common causes. It is frequently noticed in anæmic persons, and the chlorotic are especially disposed to it. Derangements of the sexual system, as in hysterical girls, and in men as a result of excesses in venery, are predisposing causes of palpitation of the heart.

Symptoms.—Palpitation is a very frequent symptom in valvular or organic disease of the heart. When independent of organic cardiac disorder, the attack is sudden, and generally occurs at night, and is often preceded by symptoms of indigestion. The patient complains of great uneasiness in the region of the heart, of faintness or giddiness, and coldness of the surface. During the paroxysm there is an accelerated beating or throbbing of the heart, and sometimes noises in the ears. The patient looks anxious, and there is a feeling of dread and dyspnœa. The impulse of the heart, as seen and felt, is diffused and exaggerated; it may be so violent as to shake with each stroke the hand applied to the chest. The pulse varies in character and frequency in different cases. Sometimes it is full, sometimes small and intermitting. The aspect of the patient also varies. Sometimes the cheeks are flushed, sometimes they are very pale. Palpitation is often accompanied by other symptoms, such as a feeling of choking, impaired vision, a copious secretion of pale urine, and coldness of the extremities. In severe cases there is sometimes partial unconsciousness. When due to organic disease of the heart the palpitation is more frequent, and gradually grows worse, and other symptoms co-exist.

Physical signs.—In addition to those already mentioned, the following are more or less frequently observed: The aorta, carotids and other large arteries throb; a soft murmur may be heard with either the first or second sound, and there is sometimes a sound resembling a friction-sound. The normal sounds of the heart are much exaggerated.

The duration of the attack varies from a few minutes to half an hour or more. During the intervals, which vary much in length, there may be either no uncomfortable sensations connected with the heart, or some amount of irritability of the organ.

Terminations.—The palpitation is occasional, and disappears wholly or partially with the removal of the cause. In organic cases it becomes chronic.

Diagnosis.—As a functional disorder it may simulate organic heart disease. In both there is often an irregular, feeble, and fluttering pulse, and murmurs of various kinds are audible. In functional derangement the local suffering is generally greater than in organic heart disease, the præcordial pain is sometimes agonising, and the patient is unable to lie on the left side, which is also tender on pressure. The absence of severe dyspnœa shows that the disorder is functional. The physical signs of valvular disease are also wanting; any murmur that may have been heard disappears with the subsidence of the paroxysm.

Treatment.—In cases of nervous or functional palpitation the cause must be sought for, and, if practicable, removed. If the disorder occurs in the subjects of hysteria or chlorosis the treatment will consist in the administration of antispasmodics, and tonics such as iron, &c. Any disorder of the sexual organs must be carefully attended to, and if the bowels are confined purgatives are indicated. Distension of the stomach and bowels must be prevented, and, when present, must be relieved by nux vomica, rhubarb, compound spirit of horse-radish, &c. A paroxysm may sometimes be relieved by alkalies, which act by neutralising acidity. In some persons a few deep inspirations cut short a paroxysm. Various antispasmodics quiet the circulation and diminish the forcible action of the heart. Ammonia, ether, musk, with nux vomica, aconite, camphor, and belladonna, are the principal remedies of this character. Hot water to the legs and feet will sometimes relieve distressing palpitation. The local suffering may be soothed by a belladonna plaster to the præcordia. As a cardiac tonic digitalis is most useful. Constipation with unhealthy secretions must be combated by cholagogues and aperients. For gouty subjects colchicum with iodide of potassium may be given with benefit. For dyspeptic cases a combination of bismuth with hydrocyanic acid and pepsine is often serviceable. Attention should be directed towards the state of the teeth and gums, and such patients should take their meals at regular hours, and the food should be properly masticated. All those substances which disagree with the stomach, and cause heartburn and acidity, should be interdicted. Hot tea and coffee and tobacco-smoking should be avoided. Weak brandy and water forms the best stimulant. In anæmia iron and various tonics are likely to prove beneficial. When the palpitation is associated with torpor of the liver, nitro-muriatic acid with some bitter infusion often does good. All measures tending to improve the general health, *e.g.* tepid or cold baths, change of air, suitable exercise, avoidance of excitement, &c., are likely to be beneficial in all cases of functional palpitation of the heart.

ANGINA PECTORIS (CARDIAC NEURALGIA).

Angina means suffocation or strangulation. Angina pectoris is an affection characterised by a train of symptoms, which indicate perverted sensibility of the heart. Most pathologists class angina among the neuroses of the heart and they regard palpitation as a neurosis of motion and angina as a neurosis of sensibility.

Pathology.—The nerves of the heart are derived from three sources; (1) the par vagum; (2) the sympathetic; and (3) the cardiac ganglia. Some attribute the rhythmical action of the heart solely to the influence of the cardiac ganglia, on the ground that if the heart be separated from the nerve-supply from the par vagum and the sympathetic it will continue to contract for some time in a rhythmical manner. The pneumogastric nerve is supposed to regulate the activity of the heart. The influence of the sympathetic is of an unknown nature. Angina has been regarded as due to hyperæsthesia of the cardiac plexus, and the pain often extends with great severity along the brachial plexus. The symptoms are due either to lesion of automatic excito-motor ganglia of the heart, whether within or outside the organ; to excitation, direct or reflex, of the vagus, causing it to exert its inhibitory influence on the heart; or to lesion of the vaso-motor sympathetic nerves. The disease is rare, and is always marked by paroxysms and intervals of immunity.

Causes.—The disease very rarely occurs before the fiftieth year. Advanced age and high living generally predispose to it, and hence old and obese persons and gouty subjects are more particularly attacked. Males are far more predisposed to it than females. The symptoms sometimes occur in persons suffering from organic disease of the heart. It may be connected with ossification of the coronary arteries disordering the nutrition of the heart or with fatty degeneration, but no lesion exists in the majority of the cases.

Post-mortem appearances.—The heart and vessels are often apparently sound; in some cases valvular (especially aortic) disease, or ossification of the coronary arteries, and atheroma of the aorta have been found after death. The heart is often more or less dilated, but no special lesion is constantly present.

Symptoms.—A sudden suffocative pain is felt in the region of the heart or beneath the sternum. The pain thence radiates to the left clavicle above, to the inner side of the left arm, or backwards towards the left scapula. The pains are often distressing both in their intensity and duration. With some, after the lapse of a few minutes, the pain gradually abates. Relapses are prone to occur.

In some cases the interval lasts for months or years; in others, the pain returns at first with long intervals, but these gradually become shorter and shorter, until an attack may occur almost daily. The patients are sometimes seized while they are walking, especially when ascending a hill. In those liable to attacks, mental excitement or physical exertion soon after eating is apt to be followed by a painful and most distressing sensation in the breast, which seems as if it would extinguish life if it were to increase or to continue. The patient imagines that he cannot breathe, but with some effort he succeeds in making a deep inspiration. The pain is very intense, often described as amounting to excruciating torture. After a few minutes the attack passes off as suddenly as it came, the pain abates and the feeling of suffocation disappears. During the attack the patient does not dare to speak, but groans and sighs. When it comes on he stands still or seeks some support. Pressure over the breast, as by clasping firmly the painful part, gives relief. The face looks pale and the limbs are cold and covered with perspiration. The pulse is small, feeble, and fluttering; but very often it is not disturbed by this pain. The expression is one of intense suffering. Abatement of the paroxysm is sometimes followed by eructation of gas. During the interval the health may or may not suffer.

After the attacks have continued for a year or more they will not cease so suddenly as in the beginning, and they are apt to come on not only when the patients are walking, but even when they are lying down, and especially after they have been lying on the left side and rise up suddenly out of their beds. In severe cases attacks are often brought on by the motion of a carriage and by coughing or straining.

Terminations.—The disease often leads to no immediate serious consequences. Usually there are brief paroxysms with intermissions. During the paroxysm the patient often feels giddy and faints and sometimes becomes convulsed. The intermission is attended with great relief, but the patient is often weak and exhausted for some time. Sooner or later the disease has a tendency to prove fatal. The patient suddenly falls down in a state of syncope, or becomes convulsed and dies. In any case consciousness is unimpared till the last. The course and duration of the disease are very variable.

Angina, as a spasmodic complaint, is known by the following characteristic points:—1. It is unattended with any fever; the pulse during the fit is not generally affected. 2. The advent and disappearance of the fit are sudden. 3. During the intervals there is often perfect health, 4. The intervals are long at first; gradually they become of less duration. 5. Opium and alcohol give relief. 6. The disease is not brought on by causes which are usual in inflammatory diseases. 7. The first attack generally occurs after sleep.

A form of angina known as pseudo-angina occurs among the young, and generally in the anæmic. It is seldom fatal. The affection is characterised by sudden præcordial pain, feeling of suffocation, palpitation, faintness, giddiness, and feeble pulse.

Treatment.—This consists in measures to be adopted: (1) during paroxysms, and (2) during the interval. (1) During the fit. The pain may sometimes be relieved by a stiff dose of brandy or whisky, combined with antispasmodics, as opium, valerian, castor, &c. The hypodermic injection of morphia and atropia is also of service. Inhalation of chloroform, sulphuric or acetic ether, is useful to relieve spasms and to lessen their duration. The inhalation of nitrite of amyl affords great relief to most cases. Locally, frictions of hot brandy or hot mustard plasters may be applied. Some recommend galvanism to the chest. If there be acidity carbonate of soda is indicated. If the attack has come on after a heavy meal an emetic will be likely to cut it short. Due regard must be paid to the state of the heart. (2) During the intervals a tranquil life, regular diet, avoidance of all sources of excitement, and attention to the state of the digestion are essential.

Violent exercise must be forbidden, and the patient, if of an irritable nature, should learn to govern his temper. If anæmia be present iron is indicated. Change of scene and travel, and various tonics, such as arsenic, silver, and zinc, will tend to improve the general health. Gout and rheumatism require appropriate treatment. Persons liable to attacks of angina should always carry about with them an antispasmodic and sedative draught (laudanum with ether, &c.). The knowledge that a remedy is at hand will tend to lessen the severity of the attack.

EXOPHTHALMIC GOITRE—GRAVES' DISEASE—BASEDOW'S DISEASE.

This affection is characterised by palpitation of the heart (often violent in degree), increased pulsation of the arteries, anæmia, breathlessness, prominence of the eyes, with peculiar startled expression, and vascular turgescence of the thyroid gland. The association of the cardiac affection with the enlargement of the thyroid gland was noted and described by Dr. Graves in 1835; and in 1840 Basedow described a similar set of symptoms under the term of "cachexia exophthalmica." Dr. Begbie, who described the disease in 1849, regarded the enlargement of the thyroid gland and eyeballs as the consequence of anæmia.

Causes.—There are two principal theories with regard to the origination of exophthalmic goitre. Some suppose that it depends upon impoverishment of the blood; others that it is due to some lesion of the vaso-motor apparatus. The affection is rare among men; it is most common in women between the ages of twenty and thirty. Its advent is often preceded by various debilitating influences, such as prolonged lactation, hæmorrhages, menstrual disorder, leucorrhœa, diarrhœa, &c. In some cases the symptoms have been preceded by violent nervous excitement due to grief, fear, &c.

Symptoms.—Before the condition becomes pronounced functional disturbances of the circulation are usually noticed. There is palpitation of the heart, increased by emotion or exertion, flushing of the face, and a sensation of fulness in the throat. The eyes become prominent and glistening, and a swelling appears over the front of the neck. These two symptoms increase *pari passu*, and the protrusion of the eyeballs is especially marked during emotional excitement, and at the menstrual periods. In severe cases the eyeballs become so prominent that the eyelids are incapable of covering them, and serious consequences have been observed to follow the exposure of the cornea. In a few cases the movements of the eye are impeded. The enlargement of the thyroid is generally unequal on the two sides, and it increases when the patient is excited. The swelling is soft and elastic, and sometimes pulsation can be detected in it.

The palpitation of the heart is always a prominent symptom; the pulsations are rapid and sometimes irregular. The heart-sounds are distinct, and a systolic bellows murmur is often heard at the base. The temperature is generally high: the patient often complains of debility, headache, and dizziness. Diarrhœa and other symptoms of indigestion are occasionally observed. Sometimes the swelling in the neck appears to embarrass the breathing and to affect the voice. Anæmia is generally a well-marked symptom. The disease often remains stationary for months or years, and then begins to decline, but it rarely happens that the symptoms entirely disappear. The patients are usually nervous and depressed in spirits.

Diagnosis.—Exophthalmic goitre can seldom be mistaken for any other disease. The enlargement of the thyroid, its pulsation, and the protrusion of the eyeballs are characteristic symptoms.

Prognosis.—Recovery is the most common termination of the affection, but in a few cases dilatation of the heart, and diminution of its functional power have been noticed. Serious symptoms, such as cyanosis, dropsy, and pulmonary venous obstruction, may in such cases terminate in fatal œdema of the lungs.

Treatment.—Improvement has often been noticed after the use of various tonic remedies, especially iron. Fresh air, rest, and a nourishing diet are also indicated. Ergot of rye has been given, as it is thought to possess the power of causing contraction of the walls of the blood-vessels. Galvanism to the neck has also been employed for the same purpose, one pole being placed behind and the other over the tumour. When the eyeballs are very prominent, they should be protected by means of a bandage or shade. Improvement has been seen to follow the application of a belladonna plaster to the tumour in the neck, and the internal administration of one sixtieth of a grain of atropia morning and evening for some weeks. Iron should be given at the same time. Iodine and its preparations are not only useless but injurious.

DISEASES OF THE PERICARDIUM.

PERICARDITIS.

Is an inflammation of the fibro-serous covering of the heart. It may be due to local irritation or to constitutional causes.

Causes.—The local causes of pericarditis include injuries, as wounds, or fractured ribs, or a neighbouring abscess in the muscular walls of the heart opening into the pericardium. The affection may be secondary, and due to extension from neighbouring inflammation of the lungs, or pleura, or peritoneum, or of posterior mediastinum, and is then localised. Growths within the pericardium, and aneurisms of the heart also lead to it. As regards constitutional causes, about one case in every six of acute rheumatism is complicated with pericarditis. Rheumatic pericarditis is more common among women than men, as five to one; is especially frequent in young and delicate women, and is rarely fatal at the time. It generally occurs when several joints are successively affected. Pericarditis is sometimes associated with chronic albuminuria, pyæmia, scarlatina, and chorea, and tubercular, cancerous, or syphilitic growths. Tuberculosis of the lung and aneurism of the aorta also lead to it. It is an occasional consequence of puerperal fever, and variola. The infection manifests itself upon the pericardium as upon the skin and other parts.

Anatomical characters.—When the disease is limited there is increased vascularity, with tendency to proliferation of the endothelium. In other cases the cell-proliferation is accompanied by interstitial exudation; at first the membrane is thick and œdematous; soon the sac becomes filled with serum and plastic coagulable lymph. In the latter form or exudative pericarditis there are two points to be considered—1, changes undergone by the pericardium, and 2, the quantity and quality of the exudation. At first the pericardium is reddened, with here and there extravasations and dark-coloured, homogeneous red spots. The tissue is relaxed with serous infiltration, and can be readily torn. The visceral surface is dull-looking owing to want of epithelium, which has fallen off; the membrane becomes shaggy, there is development and proliferation of young connective-tissue cells, forming villi and papillæ and leading to pseudo-membranous formations and to pericardial adhesions, which remain after pericarditis. The pericardial effusion or exudation presents all the modifications mentioned under pleurisy. The exudation soon separates into a liquid and a solid portion. Small accumulations are apt to form at the anterior and upper part of the sac, and at the root of the great vessels. If in larger amount, the entire sac is distended, the lower lobe of the left lung is compressed, and the thorax is dilated in the cardiac region.

Varieties of exudation.—It always contains some young cells and pus-corpuscles, but often very few. It is then a clear fluid, colourless, or of a yellowish tinge. It is called *sero-fibrinous* if only the coagulated fibrin is found in it. In such cases it is slightly opaque. Sometimes delicate fibres cross from one surface to the other. In other cases the exudation is heavily charged with *fibrin*, which is extensively precipitated on the walls of the pericardium, forming reticulated masses. This form is most common in acute articular rheumatism. *Blood* from the capillaries is often found in the exudation; if little, the serum is reddish, if much, it is black. Hæmorrhagic exudation sometimes occurs in Bright's disease and in various cachexiæ. It is also found in chronic pericarditis.

If the pericardium contains within its cavity many young cells or much *pus*, the effused contents are liquid, yellow, and opaque. The purulent exudation arises exactly as empyema, and may be found in septicæmia, in puerperal fever, &c. In very rare cases the exudation is putrid, fœtid, and ichorous.

Characters of Pericardial Effusion.

Kind of exudation.	*Diseases it most commonly accompanies.*	*Duration of the Pericarditis.*
1. Sero-fibrinous.	1. Where inflammation is transmitted from other organs.	Acute or recent.
2. Fibrinous (pure).	2. Acute articular rheumatism.	,, ,,
3. Hæmorrhagic.	3. Morbus Brightii, cachectic subjects, topers, tuberculosis.	Chronic.
4. Purulent.	4. Septicæmia, puerperal fever.	,,

Results.—In recent cases the substance of the heart is not affected. In severe or long-standing cases of pericarditis, it is sodden with serum, is soft and flabby, so that extensive dilatation often supervenes. In purulent and hæmorrhagic exudation the heart is generally found degenerated. The effects of pericarditis depend upon the degree of thickening of the pericardium and the amount of coagulated matter in the effusion. If the thickening be slight and the effused matter be sero-fibrinous and small in quantity, it is soon absorbed; the liquids are first removed, and then the solids after they have undergone fatty degeneration. The thickening leaves behind tendinous spots or adhesions between the two surfaces. These are of no consequence; but if effusion has long continued, serious consequences arise, and permanent adhesions remain. The young connective tissue becomes firm and fibrous, so that the visceral layer of the pericardium forms a dense capsule round the heart. The parietal surface of the pericardium is generally less thickened; after the effusion is absorbed it may be joined to the visceral layer. Sometimes cheesy or chalky masses are found adherent to the heart.

Symptoms.—It is rarely an independent complaint and its course can hardly be described separately from that of those affections which it complicates. When pleuritis or pneumonia extends to the pericardium, the symptoms of pericarditis are likely to be unnoticed. When pericarditis is a complication of acute rheumatic arthritis the physical signs are often the only guide. In the beginning there is rarely any rigor, aggravation of the fever, acceleration of the pulse, or any subjective signs, as pain in the cardiac region, palpitation of the heart, and subsequent dyspnœa. When, however, pain is noticed it is sometimes described as very intense; it shoots to the left shoulder or left arm, and is generally aggravated by pressure upwards upon the epigastrium. Intensity of pain shows that the pleura or the lung is implicated in the inflammatory process. Palpitation of the heart is a condition in which the action of the heart is embarrassed, and may be due in pericarditis to the pressure upon it of the exudation, to serous infiltration of the muscles, or to extension of inflammation from the pericardium to the muscular substance of the heart. Dyspnœa comes on subsequently, and is then due to passive congestion of the lung. Other symptoms may be noticed. Sometimes there is inflammatory fever, and the pulse increases in frequency: sometimes the frequency is for a time reduced, and this variation in the number of the pulse is supposed to be due to the irritation of the cardiac ganglia. In pericarditis affecting asthenic persons, or when intense, the pulse is feeble, small, and irregular, and the other symptoms resemble those of typhus or asthenic fever. Symptoms of collapse, delirium and stupor are prone to occur. The imperfect and frequent action of the heart leads to passive congestion, and the functions of the lungs and brain are disturbed. The right side of the heart is full of blood, and there is venous obstruction with imperfect aëration. The face is congested and cyanotic, and the breathing becomes hurried. Deranged function of the brain is manifested by headache, restlessness, and sleeplessness, and in some cases by delirium, stupor, subsultus, and convulsions.

The dyspnœa is increased, and is also more severe when, besides hyperæmia, there is effusion in the pericardial sac compressing the lung.

In pericarditis the decubitus is generally on the left side, and the left lung is generally compressed, but the patient often sits upright or leans forward in bed.

When pericarditis occurs as a complication of tuberculosis or Bright's disease or chronic heart disease, there are no subjective symptoms. The invasion is insidious and the physical signs are the only guide. In purulent pericarditis accompanying septicæmia the patient is quite collapsed, and there are symptoms of asthenic fever, without noticeable pain or distress.

Terminations.—Pericarditis which accompanies pneumonia, pleurisy, or acute rheumatism, generally ends favorably. The disease is always acute and recovery is complete. In cases of great effusion recovery is only partial, and permanent ill-health follows. In Bright's disease, chronic heart disease, and tuberculosis a favorable termination is less common.

When death takes place in pericarditis associated with rheumatism, it is due to derangement of the functions of the heart and lungs; œdema of the lungs ushers in the fatal termination.

The *prognosis* is highly unfavorable in rheumatic cases complicated with pleuritis or pneumonia, and not less so if Bright's disease or tuberculosis coexist. Pericarditis attended with purulent effusion is always fatal; this result is chiefly owing to the constitutional disorder.

Chronic pericarditis.—Acute pericarditis sometimes passes into a chronic form. Those cases, complicated with Bright's disease and tuberculosis, or associated with other cachectic conditions, are most apt to become chronic. A few rheumatic cases take a similar course. The disease is acute at first; afterwards the symptoms in great measure subside, but recovery is not complete, and after a time fresh pericarditis sets in. The recurrences lead to profuse exudation. The symptoms alternately abate and increase for a considerable period of time. In chronic pericarditis the exudation leads to deranged condition of the heart, which thus becomes soft and flabby and relaxed. The pulse becomes very small and irregular, and there is venous engorgement with dyspnœa. Where the exudation is profuse the venous obstruction may lead to cyanosis and dropsy. This form very rarely ends in recovery. Death from œdema of the lungs is the commonest end of chronic pericarditis.

Sequelæ.—In almost every case of chronic pericarditis the sequelæ are: 1. Adhesion of heart and pericardium. 2. Dilatation of the heart due to pressure of exudation, to serous infiltration, or to extension of inflammation to the substance of the heart. In these cases the heart becomes relaxed, and dilatation results. 3. Subsequent hypertrophy after dilatation existing for some time. 4. Subsequent atrophy or degeneration due to pressure of the pericardial exudation or to serous infiltration of the substance.

Physical signs—inspection.—In children, where the costal cartilages are still yielding, if pericarditis with effusion exists, it may give rise to bulging of the præcordial region. In adults we rarely notice any such prominence.

Palpation.—In the early stage, on putting the hand upon the chest a kind of sensation of friction may be perceived in the præcordial region. The impulse is somewhat increased, but in its proper place. When effusion takes place the impulse is weaker, and almost imperceptible, and may be felt too low down. It is weaker owing to the effusion intervening between the heart and the chest walls. When the patient lies down it disappears altogether, owing to the heart sinking back into the fluid. It is felt too low down as the diaphragm is depressed by the accumulated liquid exudation.

Percussion.—In the early stage percussion reveals nothing abnormal. In cases of profuse effusion, if the lung intervenes between the chest wall and pericardium, the percussion note will be natural. Generally, however, there is dulness at the root of the aorta and pulmonary vessels. This is owing to the heart occupying a very deep place in the fluid. When the effusion is very copious the dulness is triangular, with the base downward and the obtuse apex above. It may extend upwards to the second rib, and even higher. The right border of the triangle may pass beyond the right edge of the sternum, while on the left the dulness may extend beyond the mamillary line.

When the patient is made to lie on his back the fluid gravitates to the back part of the pericardium, and is diffused equally over the posterior surface. The apex beat may then reappear, and the percussion sound becomes clearer, inasmuch as the edges of the lungs can expand and fill up the space left vacant by the effusion. It very rarely happens that the sac is so distended that movements of its contents become impossible.

Auscultation.—The heart-sounds are feeble, and often nearly inaudible when the patient lies down. The greater the extent of præcordial dulness the more feeble is the impulse and the sounds. Besides this change a distinct "to-and-fro," or friction-sound is heard. This sound is due to the movement of the heart upwards and downwards against the chest wall, and its rotation on its own axis, after the opposing surfaces of the pericardium have lost their smoothness from inflammation. The friction-sounds are rhythmical and of longer duration than the heart-sounds, owing to the longer time required for the movement of the heart than for the production of the cardiac sounds. The friction-sounds are not isochronous with the cardiac sounds, but either precede them or last longer.

Diagnosis.—Pericarditis is most apt to be mistaken for endocarditis. In pericarditis pain in the præcordial region is more common, as is also dyspnœa and cyanosis. In pericarditis there is sometimes prominence in the præcordial region. In endocarditis this is never found. In pericarditis dulness begins at the root of the aorta and the pulmonary artery, and when the exudation is extensive the dulness assumes a triangular form. In endocarditis there is no dulness at first; after a time dilatation of the right ventricle occurs, and causes some amount of dulness.

Auscultation—murmurs or false sounds.—These vary (1) in quality. In endocarditis the murmurs arise in the heart, and are due to the roughened endocardial surface being rubbed against by the current of blood. In pericarditis the sounds are produced by the rubbing together of the two roughened surfaces of the pericardium. In pericarditis the sounds are like those of scratching or scraping. 2. Points at which they are best audible. In endocarditis and valvular disease the murmurs are very rarely superficial. In pericarditis the sounds are superficial; the right side of the heart lies in contact with the side of the chest, and rubs against the thoracic wall during diastole and systole, and produces the sound, which is therefore often heard over the right ventricle. 3. The time at which they are heard. In endocarditis they are isochronous with the heart-sounds, and may supplant them, while the pericardial murmurs either precede or follow the sounds of the heart. 4. Extension of sounds. In endocarditis they extend or are transmitted with the current of blood. In pericarditis they are confined to a small area. 5. Pericardial sounds change with the change of posture. Endocardial sounds are fixed.

Friction-sounds, due to pleurisy affecting the portion of the pleura which overlies the pericardium, are readily distinguished from those due to pericarditis. In both cases friction-sound is heard during the beating of the heart, but the pleuritic sound, or the extra-pericardial murmur, generally ceases during inspiration.

In pericarditis the friction-sounds are superficial and heard over a small area; they are sometimes intensified or altered by pressure

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Auscultation.—The heart-sounds are feeble, and often nearly inaudible when the patient lies down. The greater the extent of præcordial dulness the more feeble is the impulse and the sounds. Besides this change a distinct "to-and-fro," or friction-sound is heard. This sound is due to the movement of the heart upwards

Treatment.—The disease is always secondary, and attempts must therefore be made to relieve the primary disorder. Diuretics and purgatives are seldom of any avail for lessening the amount of the effusion. If life be threatened by sudden effusion paracentesis may become necessary.

PNEUMO-PERICARDIUM.

This condition may be caused by wounds of the thorax, or by perforation of the pericardium by a carcinoma of the œsophagus or of the stomach. Cavities in the lungs may also extend and open into the pericardium. A pyo-pneumothorax has been known to take the same course. In other cases the gas is generated by the decomposition of the effusion.

Anatomical appearances.—The pericardium is distended and contains air and fluid. The fluid may be the result of previous pericardial effusion, converted into a putrid exudation, it may be the cancerous discharge, or the broken down lung-substance. On cutting open the sac, air escapes with a hissing sound.

Symptoms.—The presence of gas in the pericardium is of fatal augury, except in traumatic cases. The patient is in a condition of collapse which passes into death. Ringing or splashing sounds can be heard, sometimes even at a distance from the patient. These are due to the agitation of the contents of the pericardium by the movements of the heart. The cardiac region is prominent and the intercostal depressions are wanting over the heart. On *percussion*, the præcordial region yields a clear tympanitic sound. On auscultation the splashing sound is heard. The heart-sounds are feeble and distant, but if the heart is acting strongly, the sounds acquire a peculiar ringing metallic tone. Friction-sounds may also be heard. Pulmonary cavities situated near the heart may communicate a metallic quality to the sounds, but it is of a less decided character.

The *prognosis* is decidedly unfavorable, except in traumatic cases. The *treatment* is that of the symptoms of collapse.

NEW GROWTHS WITHIN THE PERICARDIUM.

Tubercles are sometimes met with in the fibrinous layers of a pericardial exudation. They are found in the tissue of the pericardium only in acute miliary tuberculosis. No symptoms of pericarditis are present.. The patient dies with acute febrile symptoms. When tubercles develop in a pericardial exudation, the symptoms are those of chronic pericarditis.

Cancer of the pericardium is almost always due to extension of the disease from neighbouring parts, but it may appear independently after extirpation of cancer of the breast, &c. Cancer under the pericardium will cause no friction-sound, unless the serous surfaces be rough or at least dry. Sometimes the growth is diffuse; sometimes in separate masses or nodules. Sero-fibrinous effusion almost always takes place. The diagnosis must be made by the aid of coexisting symptoms.

DISEASES OF THE GREAT VESSELS.

INFLAMMATION OF THE COATS OF THE AORTA.

Aortitis is an inflammation of the coats of the aorta. It may occur separately in each of the three tissues—external (tunica adventitia), middle (tunica media), and internal (tunica intima). It thus resembles (1) pericarditis, or inflammatory derangement of nutrition, which is attended with exudation and effusion and also with proliferation of the pericardium; (2) myocarditis, or inflammation of the muscular fibres, which have a tendency to become soft and flabby and ultimately disintegrate; and (3) endocarditis, where the inflammation is of the inner coat. It is a sort of parenchymatous inflammation without any exudation, but the normal elements swell and the cells proliferate.

External coat.—Acute inflammation of the external coat is rare. It occurs only as a result of the extension of inflammation or ulceration from neighbouring parts, as the œsophagus, trachea, or the lymphatic glands. Chronic inflammation is apt to occur in cases of pericarditis.

Middle coat.—When the external coat is inflamed the middle coat also sympathises. Simple atrophy and fatty degeneration of the middle coat are sometimes observed.

Internal coat.—Disease of the internal coat is common. Endarteritis is a parenchymatous inflammation which originates in the lining membrane and leads to ossification and atheroma of the arterial walls. It is very common in advanced age, and in gouty, rheumatic, syphilitic, and drunken persons. It occurs at points or parts of the aorta where there is greatest strain or distension, such as the ascending portion and arch. In cachectic persons it is due to diseased condition of the blood, which acts as an irritant to the coats. It also accompanies hypertrophy of the heart in young persons. The inflammation often remains limited, or involves other coats only by extension.

Post-mortem appearances.—Acute inflammation of the external coat, as evinced by congestion, thickening from exudation, or formation of pus in its tissues, is very rarely observed. Chronic inflammation is common, and we notice the aorta usually narrowed at first and after a time widened in calibre. In inflammation of the middle coat there are red spots which are elevated above the surface in the form of infiltrated granules. In some places these become liquefied and pus is formed. In chronic endarteritis the lining membrane is relaxed and infiltrated or thickened, nodulated, and covered with deposits. The deposit is either jelly-like and moist, or forms semi-cartilaginous and opaque bluish white plates like boiled white of egg. Under the microscope they consist of fusiform cells and broad fasciculi of connective tissue. The nodules are chiefly found at the point of bifurcation of the vessels. The inflammatory products undergo fatty metamorphosis and calcification or ossification. These degenerations in arteries are common with the advance of years, and are known by scattered yellow spots on the lining membrane. The deposits are at first converted into fat globules, within the connective-tissue cells. When degeneration takes place there is a tendency for these cells and other structures to break down, forming a paste-like fluid which is eventually discharged into the circulation. This condition is true atheroma which consists of fat molecules, *débris* of connective tissue, and crystals of cholesterin. Degeneration also gives rise to abrasions, ulcers, or cavities in the arteries. Very often the inflammatory change is associated with calcification or ossification. Salts of lime are deposited in the tissues which intervene between the fat-cells. The calcareous matter often forms lumps or transparent plates, like bone, which ultimately become detached, leaving ulcers behind. Arteries very often feel like rigid cylinders. The aorta is most subject to these degenerative changes. In endarteritis in the early stage the middle tunic does not participate in the inflammatory changes. In advanced atheroma it becomes altered; it looks yellow, relaxed, and often atrophied and thinned. The external coat also suffers at an advanced period. It looks swollen and thick. All these changes are not observed in every part of the inflamed vessel. In some places there is only one phase of the disease. Thus we notice cartilaginous induration at one part and atheroma at another; ulceration in one portion and calcification at at another point.

Symptoms.—These are generally due to the grave disorders with which it is complicated. In cases of endarteritis and atheroma, the coats are degenerated and have therefore lost their elasticity. The heart, in order to overcome the increased resistance, becomes hypertrophied. The disease often extends from the aorta to the valves, and hence diseases of the valves complicate the lesions of the vessels. When the disease occurs in very debilitated subjects there is failure of general nutrition, and hence compensatory hypertrophy does not take place. The symptoms, generally, are those of degeneration of the heart, and cyanosis; dropsy and suppression

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Results.—Inflammation of the aorta often leads to aneurysm, rupture of the vessel, and to obstruction of the smaller arteries by a detached clot.

ANEURYSM OF THE AORTA.

The term *dilatation* is used to express a uniform enlargement of an artery for a certain length. This is apt to occur as a result of hypertrophy, and a similar condition is sometimes found in front of a narrowed portion. *Aneurysm* is an abrupt enlargement of a circumscribed tract, and when in the abdomen or thorax, it often attains a very large size and leads to *visceral displacements.* If within the thorax it is apt to cause displacement of the heart, trachea, and large vessels. It also causes *pressure* on hollow tubes, as the œsophagus, trachea, or bronchi; it also very often compresses the lungs, and thus interferes with their functions. It has also a tendency to destroy by pressure *unyielding tissues* with which it may come in contact; the bones of the chest wall and the bodies of the vertebræ are sometimes thus destroyed. It also sets up in the surrounding parts *irritation* and inflammation, which end either in adhesions, exudation, or suppuration. Very often an aneurysm presses upon the course of *nerves,* and even upon nerve-ganglia, and gives rise to tingling sensations and pain, or to motor and sensory paralysis.

Causes.—Spontaneous aneurysm is an abrupt enlargement caused by degeneration of the arterial walls. This is a disease of adult life, and is more common in males than females. This is due to the difference of occupation of the two sexes. It chiefly occurs as a result of chronic endarteritis or of atheroma of the vessel. It may also be due to fatty degeneration of the middle and internal coats. In old people aneurysm often occurs as a result of simple atrophy or thinning of the aorta. Increased pressure of blood also leads to it. Thus in Bright's disease even the healthy portion of the artery in the neighbourhood of the diseased part is apt to become considerably dilated. As an effect of accident or injury aneurysm is most frequent in those vessels which are most exposed to violence. Aneurysm generally begins in the middle coat; the aorta loses its elasticity, and becomes dilated by the pressure of the blood. In such cases any sudden strain, as lifting heavy weights or other violent effort, causes laceration of the middle coat of the artery, and the other coats then dilate. The explanation of this causation of aneurysm is that during an effort the muscles generally contract, many of the capillaries are compressed, and thus an extra strain is thrown upon the aorta.

Characters.—Aneurysms may be (1) globe-like or circumscribed, as when the dilatation involves a very short portion and all the coats of the artery; (2) fusiform where the dilatation decreases gradually; (3) diffuse when the dilatation occupies a very considerable portion of the vessel; (4) sac-like when an aneurysm is attached by a neck, or the tumour appears as if constricted at its base. In some cases several dilatations take place within a short distance of one another. They vary considerably in size. Aneurysms of those portions of the arch embraced within the pericardium are rarely as large as a hazel nut, while those of the aorta, which originate beyond the pericardium, may reach to the size of a child's head. As an aneurysm enlarges its true coats disappear to a greater or less extent under the pressure; the surrounding organs or tissues often become involved in it, and take a share in the formation of its walls. If the enlargement be slow the new wall thus formed becomes firm by proliferation of the connective tissue; if rapid, the wall remains thin, or even bursts.

Contents of the cavity.—The cavity, if of a large size, generally contains deposits of fibrin in separate layers. Those in the centre are red and soft; those attached to the walls are firm and dry, and yellow or light red in colour; it may also contain fluid blood or coagula, formed by slow deposition, owing to roughness of the surface or to stagnation of blood. Any vessels given off from the aneurysmal portion are generally blocked up with clots.

The effects of aneurysm.—These depend upon the amount of displacement and pressure it inflicts. It may displace or press on (1) the main vessels of the chest; (2) the nerves; (3) the neighbouring structures, as the trachea, œsophagus, and bronchi; (4) on the spinal column. Another effect of aortic aneurysm is increased action of the heart, or hypertrophy. When an aneurysm presses on a vessel it leads to obstruction and to improper supply of blood to the part; when on a nerve it interferes with the motor and sensory functions of the part. Death most often takes place either suddenly from spontaneous rupture of the sac, or gradually from exhaustion or debility brought about by repeated hæmorrhages. The opening may take place into the pericardium or pleura, the tumour giving way at its thinnest point, or adhesions may first form with the œsophagus, trachea, or bronchi, and an opening be formed by a process of absorption or by sloughing. Sometimes rupture takes place externally by the operation of similar processes.

In other cases the fatal issue is the result of pressure on neighbouring organs.

Seat.—Aneurysm of the aorta may be thoracic or abdominal. The thoracic aneurysms are met with in different parts of the arch, in the descending aorta, and in the roots of the large vessels arising from the arch. The most frequent seat is the ascending portion of the arch before the origin of the arteria innominata. Those which are embraced by the pericardium are always small in size; those occurring beyond the pericardium are often of a large size, and project anteriorly towards the thoracic wall, forming pulsating tumours towards the right half of the sternum. The resulting pressure sometimes causes destruction of the sternum in the region of the upper ribs and right costal cartilages. Such aneurysmal growths either burst externally or open into the pleural sac. Those proceeding from the convexity of the arch expand upwards and forwards and to the right, and may project close to the right sterno-clavicular articulation. Aneurysms from the concavity of the transverse arch may press upon the trachea, œsophagus, and the bronchi, and may open into any one of these parts. Aneurysms of the descending aorta are not easily detected until they attain a large size. They often compress the left bronchus, and may open into the left pleura, or, by causing destruction of the backbone, open externally.

Aneurysms of the abdominal aorta are more frequent above than below the cœliac axis, and the superior mesenteric arteries. They are often of considerable size, and project from the anterior surface and burst into the peritoneum, or extend backwards and destroy the spinal column.

Symptoms. — Many subjects of aneurysm die suddenly, from internal hæmorrhage, without any signs of the existing tumour having become manifest. In a majority of cases, however, there are subjective symptoms causing very great distress, and these are generally associated with objective signs. The symptoms are those of pressure on the neighbouring organs, and of the imperfect or obstructed flow of blood to the part which the artery supplies. Owing to compression of the lung or the bronchi, dyspnœa of a very severe character is a common symptom. Similarly pressure on the trachea may lead to alteration of voice, hæmoptysis, and intense dyspnœa, accompanied by a whistling noise on coughing and upon taking a deep breath. Pressure on the pneumogastric or the recurrent nerves leads to spasmodic dyspnœa resembling attacks of asthma. The pressure of an aortic aneurysm on the right heart may cause obstruction to the venous circulation. The pressure on the right auricle or large veins, as the vena cava or the innominate veins, causes the jugular veins to swell, and there are distinct and prominent marks of tortuous blue veins upon the chest and the arms. There may also be dropsy confined to the upper half of the body. The congestion of the cerebral veins leads to headache, dizziness, ringing in the ears, and attacks of faintness. The pressure on the main arteries, as the innominate and the left subclavian, causes obstruction to the general circulation, and alters the character of the radial pulse. The pulse at the wrist is small and unequal. Pressure on the œsophagus causes dysphagia and emaciation. Extreme emaciation shows pressure on the thoracic duct. Pressure on the vagus and pulmonary plexus causes disturbed breathing and disturbed heart's action; pressure on the recurrent laryngeal gives rise to dysphonia and laryngeal cough. Pressure on the brachial plexus causes violent pain on the right side of the chest and arm, and sometimes paralysis of the arm. In aneurysm of the *ascending arch* of the aorta the effect of the pressure is displacement of the heart downwards.

Symptoms of retarded circulation of blood.—The pulse varies in character. A distinct pause may be perceived between the beat of the heart and the wave of the arterial pulse at a point below the aneurysm. Thus in aneurysm situated between the points of origin of the innominate and left subclavian arteries the pulsations at the two wrists are not felt simultaneously, but one is later than the other. In aneurysm involving the descending aorta the pulse in the lower extremity is felt later than that of the wrists.

Progress of the tumour.—As the aneurysm extends forwards there may be throbbing pain, with tenderness in the chest, and even corrosion or penetration of the thoracic parietes. If it passes backwards the pain may be gnawing owing to the destruction of the vertebræ. The patient looks extremely anxious and has a sallow cachectic look; he generally lies with the head high, and in a prone position, bending the head forwards, and then throwing it suddenly backwards. Besides cough, dyspnœa, and difficulty of swallowing, there is occasionally permanent contraction of the pupils due to pressure on branches of the sympathetic. Patients sometimes expectorate blood for weeks or months before death. An aneurysm of the *transverse* arch, springing from its convexity, often expands upwards to the right, and destroys the sternum, clavicle, right upper ribs, and rises from behind the sternum into the root of the neck. It often attains a large size before it eventually bursts. Aneurysms of the *descending aorta* are not detected externally until they attain a large size. The tumour comes to the surface and bursts. The skin over it becomes thinner and ultimately sloughs. The blood on rupture may escape in a stream or may only trickle down owing to the coagula being formed in the sac before it bursts.

There are several marked symptoms by which aneurysm of a particular portion of the arch of the aorta can be recognised with precision during life. Thus in case of an aneurysm of the ascending portion, the venæ cavæ and lungs are compressed, and we find distressing dyspnœa, cyanosis, and dropsy of the upper half of the body. In aneurysm of the arch, the pressure exerted by the tumour is on the trachea and par vagum, and gives rise to cough, alteration of voice, hæmoptysis, &c. Pressure on the œsophagus leads to dysphagia. There is also inequality of the pulse at the two wrists. In aneurysm of the descending portion there is some pain in the back, and if the vertebræ are destroyed paraplegia may supervene. The pressure on the lungs may cause dyspnœa, and that on the œsophagus difficulty of swallowing.

Aneurysm of the abdominal aorta gives rise to various subjective symptoms. The pressure on nerves causes a severe neuralgic pain in the back or waist; the destruction of the vertebræ may ultimately lead to paraplegia with anæsthesia and loss of reflex excitability. The pressure on the alimentary apparatus leads to colic, constipation, and vomiting. There is sometimes sudden pain complained of in the belly, and this is relieved by lying on the face. These symptoms are sooner or later associated with general debility. Pressure on the liver causes jaundice; pressure on the kidneys may lead to suppression of urine, sometimes preceded by inflammation of the bladder and albuminuria. The disease ends in death. When paraplegia sets in, and if the patient survive for some time, gangrene of the feet is likely to supervene.

Physical signs.—So long as the tumour is deeply seated in the chest physical signs may be wanting. There may be defective breath sounds on one or the other side. The diagnosis becomes clear when the tumour approaches the surface. Pulsation at the point of contact, and isochronous with the apex beat, may be both seen and felt. Aneurysm of the ascending aorta forms a pulsating tumour in the second right intercostal space near the sternum. That of the transverse portion of the arch is situated at the level of the manubrium, but when large extends to the left of that bone. In aneurysm of the descending aorta the tumour when prominent is seen and felt in the neighbourhood of the lower dorsal vertebræ on the left side. When the size of the aneurysm is considerable the external appearances undergo various alterations. *Percussion* is dull or flat all over the tumour, which appears externally as a hemispherical or an irregularly globular body. The sense of resistance is increased. *Auscultation* detects a rough systolic murmur, and occasionally a diastolic one if the aortic valve is insufficient. There may be absence of respiration on one side from pressure on a bronchus. There are signs of hypertrophy of the left ventricle.

In abdominal aneurysm the physical signs are:—*Inspection.*—A tumour is found just above the navel. On *palpation* a tumour forcibly pulsating can be felt a little after the apex beat. *Auscultation.*—Under the stethoscope a short, loud, bellows murmur will be heard, accompanied with a thrill. The murmur is propagated into the iliac and femoral arteries.

Aortic pulsation is a functional disorder characterised by violent throbbing observed in the abdomen. It causes annoyance and often produces sickness; in thin persons it may be seen and felt at the epigastrium, or at the umbilicus. It gives to the hand a jerking, quick, strong, forward impulse, and is synchronous with the pulse. Under the stethoscope we hear a systolic murmur. The condition generally occurs in anæmic persons.

Diagnosis.—It may be mistaken for a solid mediastinal tumour, carcinoma of the pleura, for any consolidation at the apex of the left lung, for swelling over the sternum from an abscess, or periostitis. It is necessary to remember that tumours having their seat over a healthy artery receive pulsation from it. Again, if such tumours cause pressure upon the aorta they may produce a murmur. We have therefore to make our diagnosis by considering the history, by noticing that aneurysms dilate with every beat, that they pulsate from the very first, and that they become hard and firm subsequently, and that their size becomes diminished by gentle continued pressure. Moreover, the symptoms of aneurysm are characterised by intermissions and exacerbations. The difference between the radial pulses is characteristic of aneurysm.

Prognosis.—As a rule it is very unfavorable. Persons with strong constitutions and favorably situated may live for some years, but recovery is rare.

Treatment.—All measures which lower the system tend to increase the danger. It is well to avoid those remedies which reduce the pressure of blood from within and are supposed to check further expansion, and also those which reduce the volume of the blood. Astringents such as tannin and acetate of lead, given with a view to coagulate the blood, are worse than useless. The rational treatment of aortic aneurysm is in many respects the same as that of cardiac disease. Bodily and mental exertion is to be avoided, rest, generous diet, and attention to the digestive and other functions are advisable. Our endeavour ought to be to palliate the symptoms as they arise. The pain and dyspnœa may be relieved by sedatives, such as morphia, chloral hydrate, [illegible], and [illegible]

Some recommend iodide of potassium in these cases, but its effects are not certain. Many operative procedures have been resorted to, but without success. The principal of these are the injection of perchloride of iron or ergotine into the sac, electro-galvanic puncture with a view to coagulate the blood, and the introduction of foreign bodies into the sac. When the tumour appears externally the local application of cold will afford relief to the symptoms.

DISEASES OF THE PULMONARY VESSELS.

The pulmonary veins are seldom the seat of disease. Affections of the pulmonary artery are more often met with, but are still rare. This vessel and its branches are the occasional seats of inflammation, atheroma, and other degenerative processes. Ulceration of the intra-pulmonary vessels, as a result of extension of ulceration from the tissues of the lung, is of common occurrence, and sometimes causes fatal hæmorrhage.

Pulmonary aneurysms and dilatations constitute about 3 per cent. of cases of aneurysm generally. The dilatation may affect the trunk uniformly, or may be limited in extent. These aneurysms have been noticed in cases of mitral stenosis and in emphysema. In both cases the aneurysms are due to the diminished resistance of the arterial coats to the increased pressure of blood. In pulmonary phthisis, attended with ulceration and destruction of the pulmonary tissue, changes take place in the lung structure, and as a consequence the vessels lose their support, and aneurysm may result. The contents of pulmonary aneurysms are never laminated coagula, but always fresh clots.

Physical signs of an aneurysm of the pulmonary artery.—Violent pulsation and prominence of the vessel to the left of the sternum, and most marked in the second intercostal space. Auscultation reveals a superficial systolic bruit, which is not conducted above the sternum or the clavicle. A systolic thrill is also felt. The second sound is accentuated and right heart is hypertrophied.

Symptoms.—If the aneurysm interferes with the pulmonary circulation it will give rise to lividity, dyspnœa, and general anasarca, and there will also be cough and scanty, high-coloured urine. Where the aneurysm is small, and within the lungs, there are no symptoms during life, until hæmoptysis reveals rupture of the sac.

The disease is always fatal. Aneurysms of the trunk of the pulmonary artery generally burst into the pericardial sac.

Embolism and thrombosis in the pulmonary artery are somewhat common. The plug may consist of substances carried from other parts, or of coagula originating within the vessel itself. Those from other parts have various sources of origin; some are developed in the systemic veins; others are formed of the contents of hydatid or other cysts, or of fragments of cancerous or other growths which having found their way into the veins, travel towards the heart and pass into the pulmonary artery. Once lodged, the plug increases in size by fresh deposition of fibrin over its external surface, and thus leads to greater obstruction to the pulmonary circulation. Thrombosis or obstruction in the pulmonary artery by coagula originating within the vessels sometimes occurs in cases of degeneration of the artery itself. Coagula are more frequently developed in the smaller branches in cases of pneumonia, phthisis, and other destructive lung diseases. In poor states of the blood, as in the puerperal condition, in extreme anæmia, and in certain septic states the blood exhibts a tendency to coagulate in the pulmonary artery and its branches.

Symptoms.—In slight cases there is very little of a definite character to attract attention. There may be slight dyspnœa and occasional hæmoptysis, but these may be due to the lung mischief. Where the large branches are involved in the obstruction the dyspnœa is very severe, there is great distress, marked lividity, pain over the præcordia, palpitation of the heart, and cold sweats. The pulse is very feeble and almost imperceptible. Such cases generally end fatally, and death may supervene with great rapidity.

Diagnosis.—This is extremely difficult. Where death occurs suddenly it may be attributed to rupture of the heart, to thoracic aneurysm, or to angina. In no case can a positive diagnosis be arrived at, except where there is a history of phlebitis, *e. g.* in a woman after childbirth, and the symptoms as above described set in suddenly.

Treatment.—The patient generally dies before any remedies can be obtained. If life be prolonged stimulants, as brandy, musk, ether, and ammonia are indicated. If the patient cannot swallow, ether may be injected hypodermically, or brandy and milk may be administered through the rectum. Mustard plasters or turpentine stupes should be applied to the præcordia.

DISEASES OF THE ORGANS OF DIGESTION.

The digestive organs include the whole of the alimentary canal from the mouth above to the anal aperture below, together with two important glands, viz. the liver and the pancreas. The function of these organs consists in the preparation of the food for its assimilation and absorption into the blood. Many articles of food require chemical and mechanical preparation before they are ready for absorption; in the case only of a few, no such preparation is requisite. In order to insure the attainment of these objects, nature has provided in the construction of the alimentary canal certain receptacles into which the food is taken, and others from which effete products escape; it has also provided muscular structures for executing the necessary movements. To effect the required chemical changes the food is subjected to certain secretions, known respectively as the salivary, gastric, pancreatic, hepatic, and intestinal. Under their operation the food is converted into a diffusible and fluid state. Besides these arrangements there are others which provide for the ready absorption of the prepared materials. In order to regulate the action of the parts and to keep it in harmony with that of other systems there is a controlling influence exerted by the sympathetic and the cerebro-spinal nervous system.

In states of disease one or more of these organs become deranged; and assimilation and absorption are interfered with. The normal secretions, which convert the food into a diffusible and semi-liquid mass, are more or less altered. The sympathetic and the cerebro-spinal nervous system becomes deranged. The derangement of the normal structure of the tissues composing the organs of the alimentary canal consist in changes in their vascular supply, and in their epithelial, connective and muscular structures.

The structural changes in the tissues of the digestive organs give rise to a variety of diseases. Those due to changes in the vascular supply are known as 1st, congestion or hyperæmia; 2nd, results of congestion or hæmorrhages; 3rd, anæmia; 4th, emboli and thrombi; 5th, inflammation and its results, as abscess, ulceration, sloughing, gangrene. Other affections are, 6th, hypertrophy; 7th, atrophy; 8th, degenerations; 9th, changes in the biliary, pancreatic, and salivary secretions; 10th, new growths, as cancers, sarcomatous growths, polypi, cysts, hæmorrhoids, &c.

Malformations and malpositions constitute another group of disorders connected with the digestive organs. Foreign bodies sometimes lodge in the alimentary canal and give rise to serious complications. Parasites are often found in the stomach and intestines and also within the liver.

DISEASES OF THE MOUTH.

These affections reveal clinically the state of the system in general and of the alimentary canal in particular. They are connected with one or more of the following symptoms: 1, altered taste; 2, changes in the various movements in the mouth; 3, changes in the quantity and quality of the secretions; 4, a fœtid odour of the breath; 5, morbid changes of the parts affected and of the glands in their neighbourhood.

INFLAMMATION OF THE MOUTH—STOMATITIS.

It is a common disease in infants and young children. It affects the mucous follicles of the mouth and the tissues of the cheek and also the gums. Sore mouth may be the result of one or more of several pathological changes. Though the causes are various the main symptoms, so far as the patient's sensations are concerned, are the same and are indicated by the heading. Oral catarrh is an accompaniment of most kinds of sore mouth. It also occurs alone; but in the adult it seldom is so severe as to amount to soreness. In the infant it causes so much distress that it may be included in this division.

Varieties.—Stomatitis presents three varieties. The most common is simple stomatitis, otherwise known as follicular stomatitis. This affection occurs in young children and especially in those who have been neglected in various ways. It is especially common in those who have been brought up by hand and fed on artificial food, or suckled too long; in those who have come into the world before the full period, and in children of poor or syphilitic or cachectic parents. Dentition, rough teeth, and mercury are common sources of irritation of the follicles of the mucous membrane. The inflammation may also be propagated from neighbouring organs, as in erysipelas of the face, inflammation of the fauces, and acute and chronic catarrh of the stomach. Stomatitis is often a symptom of constitutional affections, as in children recovering from eruptive fevers, such as typhus and scarlatina. It may also indicate other morbid states sons, and occurs generally in cachectic children, sometimes supervening upon measles, less commonly upon typhus and pneumonia. It is a dangerous affection, and for the most part limited to children between one and three years.

Morbid appearances and symptoms.—It usually commences on the inside of one cheek, generally near the angle of the mouth, and over a spot hardened by infiltration. The cheek becomes red, œdematous, and shining, and a vesicle often rises upon it. The neighbourhood of the vesicle is red at first, but soon becomes black, and is covered with a slough, which on separating leaves an ulcer. The gangrenous process spreads over the cheek, lips, and gums, and may even extend to the face. The internal surface is the seat of a deep, foul ulcer. When the slough separates the teeth often fall out; the bones become exposed, and even necrosed. The gangrene, instead of spreading, often causes a deep hole in the cheek. Externally there is circumscribed œdema and tenderness at the angle of the mouth or at some part of the cheek and lips. As the disease advances from within the soft tissues soon slough. A hard, rounded mass is formed in the centre, over which the skin is shining and mottled. The surface is generally cool, the gums congested and spongy. The pulse is small, rather frequent, and the patient is little affected in spirits. On the fifth or sixth day a black slough may form, which increases till it affects the lips, or, spreading to the gum, involves the alveolar processes and loosens the teeth. The pain may be slight or absent in the affected part. There is horrible fœtor of the breath and a profuse flow of fœtid saliva mixed with blood or with gangrenous discharges. In this disease a previously strong patient soon becomes extremely prostrate; delirium or drowsiness often sets in, ending in death from asthenia in a few days. If recovery takes place a deformity remains.

Treatment.—Every endeavour must be made to support the patient's strength; diffusible stimulants, milk, beef tea, &c., should be freely given. For the relief of pain and discomfort opium is the best remedy. The mouth should be very frequently syringed with warm water and astringent and antiseptic washes, such as Liquor Sodæ Chlorinatæ and permanganate of potash. Poultices should be applied externally, and the edges of the gangrenous sore should be touched with nitric acid or the actual cautery to prevent spreading. After the slough has separated the raw surface is dressed with carbolic acid lotion. Chlorate of potash should be given internally.

APHTHÆ—THRUSH.

This affection often occurs in states of debility, in ill-nourished and improperly-fed infants, and in children recovering from eruptive fevers, as measles. It is also witnessed during the first dentition, and is occasionally associated with herpetic eruptions of the mouth. Thrush also occurs in adults suffering from protracted wasting or debilitating diseases shortly before death. Thrush often manifests itself in old age. The fungus grows when the patients are too weak to cleanse the mouth by vigorous movements of their tongue.

Anatomical appearances.—The inflammation is superficial and invades the anterior half of the tongue, the inner surface of lips and cheeks, and hard palate. There is more or less catarrh of the rest of the mouth. We find here and there white exudations; the back of the tongue is sometimes stiff and sore, and there may be cracks or fissures. The small whitish flakes, like morsels of curd, with red borders, are found on the lips, cheeks, and edges of the tongue. There is no breach of surface. They are not vesicles, but consist of exuded material. They often spread and form large patches of thick, soft fur. These flakes can readily be detached, and are soon reproduced. When forcibly removed or thrown off they carry the epithelium along with them, leaving raw superficial excoriations. These are small, flat, circular, or oval, and often occur in groups. The base is soft and smooth, and the margin is well defined. There is no thickening and no elevation. The excoriations readily heal, leaving no mark or cicatrix. If the spots are punctured no fluid exudes. In severe cases there is true ulceration. In many cases the patches consist chiefly of the spores and mycelium of the oidium albicans. Whether this fungoid growth is the cause of aphthæ or only an accidental circumstance is not definitely known. These white flakes may readily be transferred from the child to the mother's nipple. The disease often appears in successive crops one after another. At first the white flakes can be readily removed, and are soon replaced, but afterwards they become more firmly attached, and if forcibly removed they leave ulcerated spots. Under the microscope the aphthous growth is found to consist of young and old epithelium, fat-globules, and spores and filaments of fungi. The filaments are long, delicate structures, from which short, reticulated pedicels take their rise, forming tree-shaped figures.

Symptoms.—Objective.—There are small, round, opaque, white elevated patches over the tongue, gums, inside of lips, cheek, soft palate, and the mucous membrane of the mouth. The patches look like clots of curdled milk, and can easily be detached. *Subjective.*—

Treatment.—In acute cases, the inflammation may be subdued by scarifying the tongue deeply, either by one or two long incisions or by several punctures. The patient should suck pieces of ice and frequently use decoction of poppy or other soothing gargle. A saline purgative is generally useful. If suffocation threatens tracheotomy should be performed. In subacute cases, the cause must be sought for and removed. Ice constantly given to suck will relieve the discomfort. The mouth should be freely cleansed with a strong solution of chlorate of potash and glycerine with warm water. When the tongue is brawny and hard as a result of exudation, support to the organ may be afforded by means of a pad fitted to the lower incisors. If the patient cannot swallow, nutrient enemata should be employed. The tongue must be kept clean by antiseptic lotions, such as a weak solution of carbolic acid. The pain is relieved by opium. In chronic cases the teeth should be looked to. Cracks and fissures should be touched with nitrate of silver, and carbolic acid lotion (gr. ij to ℥j) freely used. Dry alum in powder and a lotion of alum are often efficacious. If these fail, various other local remedies may be applied. Lotions containing chlorate of potash and borax or the dilute mineral acids may be tried. When the case becomes chronic tonics are indicated. If an abscess forms an incision should be made as soon as fluctuation can be detected.

Cancer of the Tongue.

The disease is much more common in men than in women. It is often traced to local irritation or to some previous lesion. The majority of the patients are between forty and seventy years of age.

Symptoms.—The disease is generally primary; it begins either as a small lump or growth, or as a small crack or sore. There is occasional darting pain, shooting to the temple, ear, and head. The affected part is tender, mastication is difficult, the speech is thick and indistinct, and the tongue cannot be easily protruded from the mouth. The sublingual and submaxillary glands, as well as those connected with the lymphatic system, are enlarged and painful, and there is an increased flow of saliva. Other symptoms are those of cancerous cachexia, emaciation, and loss of strength. The patients often complain of headache and giddiness. The disease once established invades more and more of the tongue. Sometimes large sloughs separate, and more or less bleeding occurs. When the surface gives way the resulting ulcer presents prominent, ragged, infiltrated edges, and an irregularly excavated floor. It is extremely painful, and often bleeds. The growth, by obstructing the pharynx, leads to difficulty of swallowing, and also to dyspnœa. By retardation of the venous current it leads to œdema of the tongue. In advanced cases pneumonia or bronchitis sets in, and soon terminates in death. The most common seat of cancer is the side of the tongue at its middle or back part. The cancer is almost always of the epithelial type; scirrhus and encephaloid are seldom met with. Epithelial cancer of the tongue has been known to originate in syphilitic affections of the organ.

Diagnosis.—Cancer often closely resembles syphilitic disease of the tongue, and the diagnosis may be very difficult. Cancerous infiltration gives rise to nodules, generally harder and firmer than gummata, but the exact amount and consistence of the infiltration may be very hard to determine, owing to the development of inflammatory swelling. The development of cancer is generally attended with pain, often shooting towards the ear, and the progress is more rapid than that of gummata. When the ulcerative stage has been reached the appearances are very similar in the two cases. In syphilis, however, the swelling of the neighbouring glands is seldom or never so considerable as in malignant disease, in which the submaxillary gland may become as large as an ordinary egg. The disintegration of a gummatous nodule begins in the interior; in cancer the ulceration commences on the surface. The base of a gummatous ulcer is generally less vascular than that of a cancerous one, which always bleeds freely. An ulcer surrounded by an induration which does not progressively extend is likely to be of syphilitic origin. In any doubtful case the effect of full doses of iodide of potassium should be tried. Under the use of this remedy syphilitic disease of the tongue rapidly improves, but no effect is produced in cases of carcinoma. In cases of epithelial cancer of the tongue the appearances may closely resemble those due to syphilitic disease. The most important diagnostic signs of epithelioma are the plugs of curdy material which may be pressed out from the mucous membrane. Tuberculous ulceration is sometimes met with in the tongue, but is always associated with tuberculosis of other organs.

Treatment.—Nothing can be done in the way of a cure in such cases. The chief indications are (1) to improve the state of general health; (2) to remove all sources of irritation; (3) to alleviate the urgent symptoms. Operative interference is chiefly to be relied upon. The pain may be relieved by opiates and other similar narcotics. In such cases the hypodermic injection of morphia affords great relief. If the patient cannot swallow, nutrient enemata should be employed.

ULCERS OF THE TONGUE.

Simple ulcers of the tongue are usually associated with dyspepsia; they occur in children who are badly fed, and in adults who eat indigestible food and drink freely. Such ulcers are found on the sides and upper surface of the tongue, and on the frænum. They are generally shallow and covered with a greyish slough. Small ulcers may be caused by local injury. Thus the tongue may be bitten, scalded, or irritated by the sharp point of a tooth or by an accumulation of rough tartar behind the lower incisors and canines.

The *symptoms* are very annoying, for the ulcers are often painful and render mastication difficult or even impossible. There is increased secretion of mucus and saliva, fœtid odour, and swelling of the tongue and of the sublingual and submaxillary glands.

Treatment.—Painting them with nitrate of silver is the best remedy. Chlorate of potash is not so useful in this malady. Attention must be paid to the state of the digestion. Purgatives or alteratives with stomachics and tonics are generally indicated. Arsenic in doses of three or four minims of Fowler's solution three times a day often acts very satisfactorily.

SYPHILITIC DISEASES OF THE TONGUE.

The tongue is subject to various lesions during the course of syphilis. Primary sores are extremely rare on this organ. Superficial ulcers are of common occurrence in secondary cases. The ulceration is mostly seen on the sides, tip, and under surface of the tongue, and is often associated with ulcers in the inside of the mouth. The tongue presents cracks or fissures, which are very painful and cause great distress owing to the irritation to which they are subjected during the movements of the organ. Mucous tubercles are also seen in the same situation as the superficial ulcers. In such cases similar growths often co-exist in the neigbourhood of the anus and the labia. In the later stages of syphilis gummy tumours sometimes occur on the tongue. The gummata vary in size from that of a pea to that of a hazel nut, and consist of granulation tissue which becomes imperfectly organised and undergoes degenerative changes. They are firm and elastic to the touch; are usually single, but sometimes multiple. Under proper treatment they generally disappear altogether, but they have a tendency to break, discharge, and ultimately to heal up; sometimes they give rise to deep ulcers which occasionally become cancerous.

In the later stages of syphilis the mucous membrane is the part generally affected. The epithelium at first presents circumscribed patches of a dead white or cloudy appearance. After a time the epithelium is removed and the denuded surface looks very red and raw; even the papillæ are obliterated. The syphilitic patches are generally slightly elevated and hard to the touch. The tongue is swollen; the breath is fœtid, and the saliva viscid and glairy. The thirst is great. In more advanced cases the tongue is covered with crusts, separated by fissures which may extend deeply into the organ and sometimes present raw and bleeding edges. As a final stage the surface becomes absolutely smooth. Hot, acid, or pungent substances cannot be taken by such patients without causing intense pain. This condition is found in persons who have long suffered from syphilis, and especially those who have been treated with excessive doses of iodide of potassium or of mercury. Dyspepsia sometimes leads to a similar condition. Gouty persons with a poor state of the blood occasionally exhibit a similar condition of the tongue.

Treatment.—This is that of syphilis generally. Much can be done by improving the general health by stomachics and tonics. In the case of superficial ulcers the best plan is to touch them from time to time with nitrate of silver. Internally the following prescription is likely to be useful: Calomel, one grain; extract of opium, two grains, to be made into twelve pills; one to be taken three times a day. A mild course of grey powder is also useful. The gummy tumours generally become absorbed under iodide of potassium or the perchloride of mercury. Mercurial fumigation often acts satisfactorily. In obstinate cases of ulceration nitric acid is the best application.

Chronic syphilitic glossitis requires a different line of treatment. We must endeavour to improve the state of the general health and of the organs of digestion. Tonics and stomachics are indicated, and large doses of sarsaparilla are likely to do good.

DISEASES OF THE SALIVARY GLANDS.

These glands and their ducts are subject to various diseases. The parotid gland is the seat of a disorder known as cynanche parotidea or mumps. Occasionally the parotid gland becomes inflamed during the height of acute diseases, and the condition is then described as metastatic or symptomatic parotitis.

Mumps, otherwise known as parotitis, is an acute specific inflammation of the parotid and sometimes of the submaxillary and sublingual glands. The disease is often attended with acute fever.

Treatment.—In acute cases, the inflammation may be subdued by scarifying the tongue deeply, either by one or two long incisions or by several punctures. The patient should suck pieces of ice and frequently use decoction of poppy or other soothing gargle. A saline purgative is generally useful. If suffocation threatens tracheotomy should be performed. In subacute cases, the cause must be sought for and removed. Ice constantly given to suck will relieve the discomfort. The mouth should be freely cleansed with a strong solution of chlorate of potash and glycerine with warm water. When the tongue is brawny and hard as a result of exudation, support to the organ may be afforded by means of a pad fitted to the lower incisors. If the patient cannot swallow, nutrient enemata should be employed. The tongue must be kept clean by antiseptic lotions, such as a weak solution of carbolic acid. The pain is relieved by opium. In chronic cases the teeth should be looked to. Cracks and fissures should be touched with nitrate of silver, and carbolic acid lotion (gr. ij to ℥j) freely used. Dry alum in powder and a lotion of alum are often efficacious. If these fail, various other local remedies may be applied. Lotions containing chlorate of potash and borax or the dilute mineral acids may be tried. When the case becomes chronic tonics are indicated. If an abscess forms an incision should be made as soon as fluctuation can be detected.

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The disease is much more common in men than in women. It is often traced to local irritation or to some previous lesion. The majority of the patients are between forty and seventy years of age.

Symptoms.—The disease is generally primary; it begins either as a small lump or growth, or as a small crack or sore. There is occasional darting pain, shooting to the temple, ear, and head. The affected part is tender, mastication is difficult, the speech is thick and indistinct, and the tongue cannot be easily protruded from the mouth. The sublingual and submaxillary glands, as well as those connected with the lymphatic system, are enlarged and painful, and there is an increased flow of saliva. Other symptoms are those of cancerous cachexia, emaciation, and loss of strength. The patients often complain of headache and giddiness. The disease once established invades more and more of the tongue. Sometimes large sloughs separate, and more or less bleeding occurs. When the surface gives way the resulting ulcer presents prominent, ragged, infiltrated edges, and an irregularly excavated floor. It is extremely painful, and often bleeds. The growth, by obstructing the pharynx, leads to difficulty of swallowing, and also to dyspnœa. By retardation of the venous current it leads to œdema of the tongue. In advanced cases pneumonia or bronchitis sets in, and soon terminates in death. The most common seat of cancer is the side of the tongue at its middle or back part. The cancer is almost always of the epithelial type; scirrhus and encephaloid are seldom met with. Epithelial cancer of the tongue has been known to originate in syphilitic affections of the organ.

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Treatment.—Nothing can be done in the way of a cure in such cases. The chief indications are (1) to improve the state of general health; (2) to remove all sources of irritation; (3) to alleviate the urgent symptoms. Operative interference is chiefly to be relied upon. The pain may be relieved by opiates and other similar narcotics. In such cases the hypodermic injection of morphia affords great relief. If the patient cannot swallow, nutrient enemata should be employed.

It is decidedly infectious, the contagion being conveyed from person to person, and the infecting particles being reproduced in the course of the disease, and given off by the sick, even before their glands are affected, and for two or three weeks afterwards. It is often epidemic, as in schools and other crowded places. It occurs, for the most part, but once in life, and generally ends in resolution. There is a tendency to metastasis to the testicles in boys, and to the mammæ or ovaries in girls. The disease is said to be due to blood poisoning.

Causes.—It is a disease of childhood, most frequent in boys and growing girls between seven and fifteen years. It may, however, occur in adults who are much with the sick. It is most common in cold and damp weather. Hygienic defects favour its production. Infants and old persons generally escape,

Anatomical changes.—In idiopathic cases these are unknown, as the course of the disease is generally favorable. Mumps may be caused either by inflammation in the gland-tissue or by catarrh of the duct. Some assert that in mumps the interstitial and connective tissues are the seat of inflammation. These tissues become hyperæmic and infiltrated with serum; and swelling is the result. In such cases there is no tendency to degeneration or suppuration. There is no fibrinous exudation poured out. The swelling often subsides in three or four days, when sometimes one testicle is affected. In a few cases other glandular or fibrous structures become metastatically affected. Alterations in the kidney have been noticed. The disease does not always run a steady course, but exacerbations and remissions are not unfrequently observed.

Symptoms.—The premonitory symptoms vary. They may be very slight, and even escape notice, or the patient suffers from fatigue in the day, restlessness at night, and occasional vomiting, before local symptoms manifest themselves. In a majority of cases there is a period of incubation of about one week; there is fever with chills, rarely amounting to rigor, and the fever soon becomes well marked. Suddenly, in a few hours, a sensation of pain or stiffness and swelling in the parotid gland are noticed. The patient is generally restless at night on account of the pain. The temperature is often 101°. Sometimes it rises to 103° or 104°. Generally the temperature begins to fall after the appearance of local signs, and on the third or fourth day it becomes normal. In some cases the progress is favorable till the end of the week, when the temperature again rises, and metastatic complications, as orchitis, deafness of one ear, albuminuria, rheumatism, and cardiac affections occur.

Pathognomonic symptoms.—The disease is generally limited to one side, but in some cases, as the swelling begins to abate on that side, pain and swelling begin to develop on the other, where, after going through successive changes, the symptoms also subside and disappear. It rarely happens that both sides are simultaneously affected. Suppuration seldom takes place. The sensation of pain and stiffness in the parotid region comes on suddenly after febrile symptoms. The swelling is deep seated, and also affects the surrounding tissues. A lump may be felt near the lobe of the ear, and often occupies the side of the face and neck. The tumour is elastic and feels soft in the centre. The fever generally declines with the appearance of the growth. Metastasis occurs at any period of the disease. The fever increases, and the patient complains of pain in the testes or the ovary. In some cases the pain and swelling of the testes set in before the stiffness and pain of the parotid have entirely disappeared, and when the testes begin to improve the parotid again becomes affected.

Treatment.— The patient should be kept well protected from draughts. Rest is essential. As the disease sets in with fever, salines are indicated. The bowels may be regulated by calomel and jalap, and the temperature reduced by rest and other suitable remedies. The patient should have Dover's powder or hydrate of chloral combined with bromide of potassium at bedtime to procure sleep. Locally the pain may be relieved by poppy fomentations and by anodyne liniments. For metastatis endeavours should be made to induce a return of inflammation from the testes to the parotid gland. For this purpose, when the pain in the testes is threatening, a large mustard plaster should be applied to the parotid region. If fluctuation appears an incision should be made into the swelling. As the disease occurs in weak and debilitated children, and especially in those who are scrofulous, a course of tonics such as iron and cod-liver oil is likely to be beneficial.

Symptomatic parotitis.—The disease sometimes occurs during the height of, or at the termination of acute diseases as typhus, typhoid, scarlatina, smallpox, and measles. There is at first congestion, followed by inflammation of the glands. There is also inflammation of the ducts. The exudation products are speedily transformed into pus. The inflammation is generally of a destructive character. Sloughing takes place and the gland and its interstitial tissue are destroyed. The disease often extends to the neighbouring connective tissue, and may even invade the adjacent muscles and bones.

Symptoms.— During the height of an acute specific fever the patient suffers from an exacerbation of the previous symptoms. The temperature rises to 104° or 105°, showing that some com-

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Treatment.— The patient should be kept well protected from draughts. Rest is essential. As the disease sets in with fever, salines are indicated. The bowels may be regulated by calomel and jalap, and the temperature reduced by rest and other suitable remedies. The patient should have Dover's powder or hydrate of chloral combined with bromide of potassium at bedtime to procure sleep. Locally the pain may be relieved by poppy fomentations and by anodyne liniments. For metastatis endeavours should be made to induce a return of inflammation from the testes to the parotid gland. For this purpose, when the pain in the testes is threatening, a large mustard plaster should be applied to the parotid region. If fluctuation appears an incision should be made into the swelling. As the disease occurs in weak and debilitated children, and especially in those who are scrofulous, a course of tonics such as iron and cod-liver oil is likely to be beneficial.

Symptomatic parotitis.—The disease sometimes occurs during the height of, or at the termination of acute diseases as typhus, typhoid, scarlatina, smallpox, and measles. There is at first congestion, followed by inflammation of the glands. There is also inflammation of the ducts. The exudation products are speedily transformed into pus. The inflammation is generally of a destructive character. Sloughing takes place and the gland and its interstitial tissue are destroyed. The disease often extends to the neighbouring connective tissue, and may even invade the adjacent muscles and bones.

Symptoms.— During the height of an acute specific fever the patient suffers from an exacerbation of the previous symptoms. The temperature rises to 104° or 105°, showing that some complication is about to set in. The restlessness increases and the patient is in great distress. On careful examination, there is discovered a small painful swelling below the ear, and the usual depression between the lower jaw and the mastoid process is soon effaced. The patient, although drowsy, feels pain on pressure over the parotid. The disease, if the health be fairly good, ends in resolution. Generally the patient is weakened by previous fever, and is extremely low; the disease therefore runs on to suppuration. The swelling after a time appears tense, shining, and presents a feeling of fluctuation. In a majority of cases the abscess opens externally, leaving a fistulous opening for a long time. Occasionally it discharges itself through the ear, mouth, or throat. Rarely the pus finds its way into the cellular tissue investing the muscles of the neck. Recovery from such a serious complication is rare. If the disease sets in during convalescence from fever recovery may be expected.

Treatment.—The patient's strength must be supported by nutritious diet and stimulants. Bark and ammonia should be prescribed. Tonics of all kinds are also very useful. Locally poultices of half wheat flour and half linseed should be constantly applied. If fluctuation be distinct the abscess may be opened.

DISEASES OF THE PHARYNX.

Diseases of the throat include various affections involving different structures. Under this heading may be classed diseases of the pharynx, tonsils, uvula, and palate. In a majority of cases all these parts are more or less involved in the morbid process, for it rarely happens that one or other of these structures is exclusively disordered. Diseases of the throat are generally primary, but may result from the extension of neighbouring diseases or of some disease of the neck.

In a general way throat diseases may be classified as follows:—1. Nervous affections. The patient complains of various sensations, although there may be no obvious disease. 2. Actual disease, (*a*) injury by irritants swallowed; (*b*) syphilis; (*c*) acute infectious fevers, as scarlatina and diphtheria; (*d*) congestion, inflammation, ulceration; (*e*) relaxation of the uvula; (*f*) morbid growths leading to obstruction; (*g*) paralysis. These are extremely frequent affections, and certain clinical features are common to the group. These are: 1. A peculiar and painful sensation in the throat. Sorethroat is a popular name for all affections of the pharynx, larynx, and tonsils. The pain may shoot upwards into the ear. There is often tenderness on pressure and during deglutition. Talking or coughing is also painful. The pain is sometimes described as burning or tearing or as a feeling of dryness and tightness. 2. Difficult or painful deglutition. 3. Oppressed breathing or feeling of suffocation. The term *angina* is applied to those affections in which this last is a prominent symptom. 4. Change in tone and intensity of voice. The voice becomes altered; it is generally thick, or husky, and coarse. 5. Peculiar cough. 6. Breath of a fœtid odour. 7. Hearing more or less defective. 8. Reflex vomiting. 9. Occasional hæmorrhage. The objective signs on physical examination by palpation and inspection are (*a*) throat either red or covered with patches of exudation, (*b*) presence of morbid growths, (*c*) alterations in the structure of the pharynx, tonsils, uvula, or palate.

The disorders to which the pharynx is subject are of various kinds. Some are met with in acute general diseases, as scarlatina and diphtheria; others are due to extension of inflammation or ulceration from other parts, and to morbid growths. The chief morbid conditions to which the pharynx is liable are acute catarrhal inflammation; and chronic inflammation, which is often of the follicular variety.

Simple or Catarrhal Pharyngitis.

Causes.—Simple pharyngitis may be due to direct irritation caused by hot or corrosive substances or by injuries such as arise when bones stick in the fauces. Exposure to damp and to draughts of cold air sometimes leads to pharyngitis. It may also be due to extension of catarrh, being preceded by coryza and followed by bronchitis. Reflex irritation of the stomach, as in hard drinkers and in those who indulge in rich and highly seasoned dishes, is a somewhat common cause. Pharyngitis is often due to some poison in the blood, as in scarlet fever, erysipelas, and measles. It is a common symptom of scarlatina. In diphtheria the pharynx is covered with a pseudo-membranous exudation. In the early stage of syphilis pharyngitis commonly occurs. The young and those whose health is reduced by overwork or by excesses are most predisposed to catarrhal pharyngitis, and a previous attack increases the predisposition. Sometimes the disease is epidemic. It always co-exists with inflammation of the tonsils.

There is a peculiar form of pharyngitis in which there is swelling of the posterior wall of the pharynx; its mucous follicles are enlarged and the vessels ramifying in the mucous membrane are swollen, giving the surface a granular appearance. This kind of pharyngeal disease is common among those who eat and drink gluttonously or who use their voice freely, as in singing and speaking. In the subjects of this affection exposure to cold gives rise to severe attacks of sorethroat. The gouty are also prone to this kind of pharyngitis.

Morbid appearances.—In acute pharyngitis the mucous membrane of the throat is thick and of a dark red colour; the submucous tissue of the uvula and soft palate is swollen, and the tonsils are enlarged. The mucous surface is dry, tense, and glistening at first, but soon becomes covered with a copious cloudy secretion, which is most abundant about the tonsils and posterior part of the pharynx. In many cases the membrane becomes covered with greyish patches, which can easily be detached and leave superficial ulcers. Sometimes the inflammation terminates in suppuration, and gives rise to pharyngeal abscess.

Symptoms.—The disease is generally ushered in by fever preceded by some degree of chilliness. The patient is restless, and has a feeling of general malaise. At first the secretion is diminished. The patient complains of a peculiar sense of accumulation in the throat, which he strives to remove by swallowing or hawking. The act is attended with soreness or even severe pain, and a sensation of heat and dryness in the throat soon becomes prominent. Deglutition is difficult or painful, owing to the dryness and tension of the mucous membrane. The patient suffers from provoking cough, owing to the uvula being elongated and the soft palate relaxed. In severe cases the muscles of the palate and pharynx are infiltrated with serum, and are unable to contract, and the food passes into the nose or back into the mouth, or even into the larynx. There is frequent inclination to swallow, owing to the uvula being swollen and acting as a foreign body. Owing to the same cause speaking produces pain. The voice is often thick, nasal, and husky, and the patient is unable to pronounce gutturals, because the uvula cannot vibrate. Cough is a frequent symptom, but the breathing is generally free and natural. There is pain in the ear and occasional deafness, due to the extension of the catarrh into the Eustachian tubes and tympanum. All these symptoms become worse at night and after sleep. Catarrhal stomatitis generally coexists. The stomach is disordered, and there is coated tongue, bad taste, increased flow of saliva, and foul breath. Generally, in these cases, the fever is moderate; the temperature seldom rises above 102°. Recovery takes place in a few days, frequently within a week.

Treatment.—The indications are to subdue the inflammation by vascular sedatives, and afterwards to promote resolution. Poultices to the throat afford relief in some cases. Inhalation of steam or a spray medicated with morphia may be used every two hours. Sucking small pieces of ice and the external application of cold are also beneficial. The patient should be purged freely by salines. Aconite is useful in acute cases. The tincture may be given in drop doses every half-hour or hour. When the swelling subsides, and there is profuse secretion, the throat should be painted with astringents, as solutions of nitrate of silver or tannin. The state of general health should be improved by tonics. Large doses of quinine are sometimes given, with a view to cut short the disease. Bland nourishing diet, as milk and yolk of eggs mixed together, may be taken.

CHRONIC PHARYNGITIS, OR RELAXED THROAT.

This sometimes follows the acute form, the condition being maintained by repeated attacks of cold. It may, however, exist without any previous acute attack. It may be due to all those circumstances which render the blood poor, as chronic derangements of the stomach and bowels, excess in smoking and drinking, as well as to the excessive use of the parts. The affection known as clergyman's sorethroat is produced by the last-named cause. A relaxed uvula also leads to it. It is a common affection among singers and speakers. It is rare among the labouring classes, and is more common in men than in women.

Morbid appearances.—The mucous membrane of the throat is red and rough, sometimes puffy-looking. It is traversed by varicose veins; is dark coloured; the glands are very much swollen and often œdematous. It is either dry and glistening, or covered with a cloudy secretion. The soft palate and the swelled glands have a rough, granular appearance, or may present numerous enlarged vesicles, which on bursting form superficial erosions or ulcers. White spots are often found covering the tonsils. The inflammation may extend into the posterior nares and to the tonsils. In some cases dry crusts (the dried secretion of the mucous glands) are found on the mucous surface. Sometimes white concretions project from the orifices of the tonsils. These are formed within the follicles, and are sometimes expelled by coughing. They are unctuous to the touch, are easily crushed by pressure, and have a fœtid odour.

Symptoms.—The disease is very obstinate. It is often an accompaniment of phthisis, syphilis, disorders of the stomach, gout, and intemperance. There is a sensation of irritation in the part and frequent desire to clear the throat; slight pain and difficulty in swallowing (especially when pungent substances are taken). Hawking and expectoration are constant symptoms. The cheesy plugs of mucus which collect during the night are often hawked up in the morning; and where the expectoration is difficult and hawking severe, some of the ramifying vessels give way and there is blood mixed with the sputa. In severe forms, hearing becomes defective owing to the extension of the inflammation along the Eustachian tubes. The voice is husky and weak, due to implication of the larynx.

Treatment.—The cause must be removed; smoking and alcoholic drinks should be avoided. Locally, various astringent sprays or caustic applications as of sulphate of zinc or of acetate of lead, of nitrate of silver (five to ten grains of the salt to an ounce of distilled water) or of alum or tannin may be used, or the throat painted with iodine solution, made up of iodine, gr. j; and iodide of potassium, gr. ij; water, ℥j. All these applications may be tried and continued according to the effect. Almond oil locally applied is often useful to relieve the sense of dryness; bromide of ammonium gargle is valuable for relaxed throat, elongated uvula, and irritable cough. Fomentations and poultices externally give considerable relief at first. If œdema is threatening, the pharynx should be scarified freely. Internally, chlorate of potash in ten to fifteen-grain doses three times a day, or iodide of potassium with decoction of sarsaparilla may be given. In many cases Liquor Arsenicalis is given with benefit. Where all these remedies fail, Liquor Hydrargyri Perchloridi may be tried. Every endeavour must be made to improve the state of general health. The patient is generally debilitated; outdoor exercise, change of air, and ferruginous tonics often lead to good results. A course of some muriated alkaline mineral waters is often very useful.

FOLLICULAR PHARYNGITIS.

This complaint is also known as granular pharyngitis. In this affection the condition of the throat somewhat varies in different cases. The posterior wall of the pharynx generally presents a mammillated appearance, the mucous follicles are distended, and hence this inflammatory condition is called follicular inflammation. The submucous tissue is also thickened and hypertrophied. Sometimes the granules coalesce and form large prominent masses. In some cases a large secretion of mucus is poured out which hardens and concretes, and forms dry, dark or greenish crusts on the posterior part of the pharynx.

Symptoms.—In such cases there is a considerable amount of coughing and hawking, owing to the difficulty of expectorating the tenacious mucus. The voice is husky and hoarse. There are frequent efforts at swallowing with constant dryness in the throat. The disease generally lasts for years. In advanced cases, the pharyngeal glands appear indurated and even ulcerated. In such cases the disease often extends to the larynx, and aphonia becomes a prominent symptom and is associated with great debility. In some cases the uvula, tonsils, and soft palate become tumefied.

Treatment.—Such patients should be restricted from following their avocations if these involve much speaking. The point of utmost importance is to improve the state of the general health. The diet should be generous and the appetite assisted by tonics and healthy exercise. Attention must be paid to the condition of the liver and bowels. Locally the means already recommended for chronic pharyngitis should have a fair trial. If the parts be much ulcerated a strong solution of nitrate of silver or of bromide of ammonium or of tincture of iodine may be employed. These applications may be applied by means of a brush twice or three times every week. A course of muriated alkaline waters is often beneficial.

Diseases of the Tonsils.

The tonsils are two glandular bodies situated between the anterior and posterior pillars of the fauces, one on each side of the throat. They are liable to be implicated in several affections of the throat. General catarrh, in which the tonsils participate, is an affection of everyday occurrence. Diphtheria, scarlatina, and syphilis are affections in which disorder of the tonsils is generally observed. The special diseases to which the tonsils are liable are acute inflammation, otherwise known as quinsy, follicular inflammation, hypertrophy, and calculus. They may also be the seat of ulcers and of gangrene, and may be involved in malignant diseases.

Acute Tonsillitis, or Quinsy—Angina—Cynanche Tonsillaris.

The English word quinsy is derived from the Greek *kunanche*. Quinsy is a name used for all acute inflammations of the upper region of the throat which directly prevent swallowing or render that act painful.

Causes.—The disease is often idiopathic; it is sometimes traced to exposure to wet and cold. The disease most commonly affects children, and is prone to recur. Persons living in ill-ventilated and crowded rooms, and in houses to which sewer gases have access, are very prone to this disease. Butlers who eat and drink to excess, and often sleep in an atmosphere contaminated with foul gases, are particularly subject to it. The disease generally ends in suppuration. The sudden onset, short duration, and rapid termination show it to be a case of acute inflammation.

Morbid appearances.—There is swelling of the tonsils, of the neighbouring parts of the throat, and of the base of the tongue. As a general rule only one tonsil is affected. In some cases the inflammation attacks one tonsil at first, and then extends to the other. The tonsil is enlarged, of a bright red colour, and infiltrated with inflammatory exudation. The surface is covered with patches of yellowish secretions, and exhibits whitish-looking opaque pellets of superabundant epithelium, which accumulates in the orifices of its crypts, giving the idea of ulceration. The substance of the tonsil becomes nodulated, and the nodules often run together.

In many cases an abscess is formed. The soft palate is also swollen, red, and œdematous, and is pushed downwards and forwards. When both tonsils are enlarged they meet in the median line, and often close the fauces. Superficial erosions are due to rubbing or mutual pressure. The uvula is also swollen, infiltrated, tense, and pendulous, and often clings to one of the tonsils. Generally the uvula is pushed to the healthy side; sometimes the salivary glands in the neighbourhood are also swollen and enlarged.

Symptoms.—It is always a painful and distressing disorder. Its onset is often rapid, and its symptoms, both local and general, are very severe. The patient complains of chills or rigors, followed by fever, and of soreness, tingling, and dryness of the fauces. The temperature often rises to 102° or 103°. The pulse is very rapid, full, and firm; the patient's face is flushed, the tongue is furred, and may be dry. There are pains in the loins, vomiting, and severe frontal headache; the patient is restless and irritable; he complains of general uneasiness, and may be delirious at night. Smallpox, pneumonia, typhus fever, typhoid fever, and acute tuberculosis are perhaps suggested to his anxious friends. The skin is hot and often moistened with sweat. There is loss of appetite, great thirst; the urine is scanty and bowels are constipated. There is great pain on moving the jaw, or on attempting to swallow. There is profuse discharge of viscid saliva, and fluid is apt to return through the nostrils. There is often deafness. Other symptoms of oral catarrh are also present. The breath has an unpleasant odour, the voice is thick, guttural, or nasal. The breathing is unaffected, although the patient snores during sleep; there is a look of extreme prostration. This state continues for four or five days, when the fever abates, the inflammation passing either into resolution or suppuration in the tonsil. When suppuration sets in, the symptoms of pain and fever are aggravated, and throbbing, extending to the ear, is complained of. After the escape of pus the patient rapidly improves. It ought to be remembered that the enlargement, acute as well as chronic, may cause deafness. This gives rise to a seeming dulness on the part of the patient, which, combined with the headache and high temperature, makes the attack look very much like the beginning of some grave fever. In most, if not in all cases, the bowels have been confined for some days. The quinsy is often relieved by purging. Still, constipation cannot be taken as a cause of swelled throat, for in the prolonged constipation of chronic lead-poisoning enlargement of the tonsils is not found.

Diagnosis.—It must be borne in mind that not only scarlatina, but typhoid fever and acute rheumatism are often attended with slight sorethroat. The prevalence of scarlet fever and the appearance of rash exclude quinsy. In suspected typhoid fever, if there be the slightest doubt, we must withhold purgatives till the thermometer has assured us that the lesser disease is present. The temperature is in some degree dependent on constipation, for in all cases, however ending, which have been freely purged, the temperature is less high. However large the tonsils, dyspnœa is rare.

Duration.—The attack usually ends within a week.

Prognosis.—This is favorable. The inflammation terminates in resolution or in suppuration, after which healing takes place rapidly.

Treatment.—The disease generally pursues its own course, but appropriate measures will afford much relief. Perfect rest and liquid diet are essential. Hot fomentations and linseed poultices to the throat or steam inhalations or anodyne vapours directed to the fauces will lessen the pain and discomfort. Sucking ice in many cases has a similar effect. At the very outset an emetic may be administered with the view of cutting short the disease, and drop doses of tincture of aconite may be given every half hour for several hours. Astringent gargles and the application of nitrate of silver are recommended. Tincture of guaiacum given in drachm doses every three or four hours has a desired effect in some cases. A third of a grain of grey powder given every hour will sometimes reduce the swelling and lessen the distress. External applications rarely cause resolution, and leeches are to be avoided. Free purgation with senna and a low diet till the inflammation subsides constitute the essential treatment in most cases. In the acute stage gargles are more painful than useful. Dover's powder may be given at night while there is pain. After resolution or suppuration ammonia and decoction of bark will help to restore the strength. When fluctuation is detected by the finger the abscess should be opened by means of a well-guarded bistoury. The discharge of the pus will afford great relief. Astringent gargles should be afterwards used. Glycerine of tannin is a good application.

Follicular tonsillitis.—The tonsils secrete a fluid which serves to lubricate the food as it passes down the pharynx and to moisten the fauces. In catarrhal tonsillitis this secretion is altered. It is also altered in cases where the interstitial tissue of the gland is thickened and compresses the follicles. The tonsils in such cases are covered with patches of greyish secretion, which are not adherent but easily removable. In some patients this condition is often observed after exposure to cold or associated with indigestion. It should be treated by attending to the general health and by astringent gargles and tonics. Chlorate of potash both internally and as a gargle is generally serviceable.

Hypertrophy of the tonsils.—The term is applied to that form of enlargement which is generally slow and progressive, and occurs in strumous children. It does not often set in with any acute attack, but sometimes inflammation of the tonsils terminates in induration or gradual hypertrophy forming indolent tumours. The enlargement, if very great, diminishes the size of the canal of the fauces and may almost entirely block it up. The disease is hereditary in some families. In adults it is frequently the result of repeated attacks of angina leading to a low form of inflammation. In hypertrophy there is no pain, the patient generally snores during sleep, and breathes with his mouth open both by day and by night.

In slight cases the patient is not conscious of the enlargement. If considerable, the voice becomes peculiarly thick, and often there is deafness. There is difficulty of swallowing, and the patient feels that there is something in his throat which needs to be swallowed. The disease is aggravated by repeated catarrhal attacks, to which the patient is peculiarly liable.

Treatment.—As the child is strumous, cod-liver oil, phosphates, maltine, and plenty of nourishment are essential. Iodide of potassium or iodine and iron may be given for a protracted period. Bromide of potassium and bromide of ammonium are said to be useful in relieving hypertrophy. Incisions into the tonsils and removal of a portion generally afford relief to all the symptoms. The removal of a thin layer of the hypertrophied tissue is often followed by disappearance of the growth. In slight cases the daily application of tincture of iodine for three or four weeks generally produces very satisfactory results. Exposure to cold should be avoided. Sea air and sea bathing are always beneficial in these cases.

Calculi are sometimes found in the follicles of the tonsils. These are yellowish white in colour, and either soft or hard and cretaceous. They consist of [illegible] and various salts of lime. They sometimes give rise to inflammation and suppuration.

RETROPHARYNGEAL ABSCESS.

Retropharyngeal abscess is a morbid condition in which pus is formed behind the posterior wall of the pharynx, and between it and the muscles lying upon the vertebral column. It is a rare affection, and strumous children are most liable to it. The cause is rarely primary; [illegible] a secondary affection, [illegible] of caries of the bodies of the cervical vertebræ, and of inflammation of retropharyngeal glands. Pyæmia is supposed to be one of its causes. It has been observed as a sequel or a complication of acute specific fevers.

Morbid appearances.—A collection of pus [illegible] the posterior wall of the pharynx [illegible]. The abscess may burst [illegible] [illegible] [illegible] [illegible]. The pharynx is [illegible] [illegible] [illegible].

Symptoms.—The disease sets in with soreness of the throat, fever, restlessness, and malaise. As the case progresses the febrile phenomena increase in severity, and the patient complains of pain and difficulty of swallowing, and these symptoms rapidly increase. Associated with the dysphagia there is stiffness of the neck, and sometimes a swelling is observed towards the angles of the lower jaw. The respiration is often embarrassed, and if the abscess is large the dyspnœa becomes very marked. There is alteration or hoarseness of voice and hawking cough. The face is anxious looking, and the lips and the cheeks appear cyanotic. The disease may be mistaken for croup. In croup the cough and stridulous breathing are characteristic symptoms, while in the pharyngeal abscess the respirations are loud and hurried. On inspecting the throat the mucous membrane is seen to be of a livid colour. At the back of the pharynx the abscess forms a protrusion, which is sometimes in the middle, sometimes on one side. It appears either as a hard and tense or as a soft yielding swelling, and when very large may protrude in front of the soft palate. The abscess may open spontaneously, and give rise to fœtid discharge from the mouth and fœtid odour of the breath.

Prognosis is very grave, especially if the disease depends upon caries of the vertebra.

Treatment.—The abscess when detected should be opened at once, and tonic treatment is then indicated.

Syphilitic Affections of the Mouth and Throat.

Syphilitic affections of these parts take the form of erythema, papules, and gummata. The lesions often coexist with cutaneous manifestations, which they more or less resemble as regards their development, general character, and course.

Erythema of the mouth and fauces often appears simultaneously with a roseolous eruption on the skin, but it is less common than this latter affection. The patient complains of soreness or pain in the throat, especially on swallowing. The mucous membrane, and especially that of the soft palate, is found to be red and swollen; the redness is uniform and extends over the pillars of the fauces, tonsils, and back of the throat. The Eustachian tubes are sometimes involved, and deafness results. Extension to the larynx may also take place and cause hoarseness or aphonia. After a few days the redness becomes less marked, the swelling increases, and the mucous membrane looks dull and somewhat opaque. These appearances may either subside or become aggravated. In the latter case the mucous membrane, especially of the more prominent parts, becomes still more swollen, and the velum is stiffened and fixed by the infiltration. The tonsils project into the throat as hard nodulated swellings, covered with more or less secretion. Small vesicles make their appearance on the surface of the inflamed mucous membrane. These consist of the inflamed and distended follicles, and are often converted into small ulcers. The surface of the tonsils is also prone to become ulcerated, and in these parts the process may extend to a considerable depth. Ulcers of the velum sometimes extend through its substance, and lead to perforation.

Diagnosis.—The symptoms of syphilitic angina closely resemble those of ordinary catarrhal inflammation of the throat. An abrupt line of demarcation is to some extent characteristic of the former affection, but the diagnosis will depend mainly upon the history of the case and the coexistence of other symptoms. Glandular enlargement will invariably be present, and in most cases there will be a roseolous or papular eruption on the skin. The angina of scarlatina is ordinarily accompanied by a more severe degree of fever.

Papular eruptions on the mucous membrane of the mouth and throat are either developed from normal papillæ or result from follicular infiltration. In the former case they appear as firm elevations resembling small warts; in the latter they consist of roundish or irregularly-shaped nodules. The arches of the palate, the tonsils, and the inner surface of the cheeks are the parts most commonly affected. These structures are usually swollen and painful before the papules appear; but the latter may sometimes be found in the absence of any other local symptoms. If the inflammation be of a diffuse character the papules may be scarcely recognisable. They may disappear by resolution or may give rise to erosions or ulcers. Such ulcers are often seen on the tonsils.

Gummatous formations sometimes appear in the hard and soft palate, uvula, and tonsils. They may be either circumscribed or diffused, and they belong to the later stages of syphilis. Small painless nodules or diffused swellings make their appearance, and these rarely become absorbed, but more often terminate in disintegration and ulceration. These processes may be of a very serious character, and may cause much loss of substance and deformity. Caries of the adjacent bones, destruction of the soft palate, and adhesion between its border and neighbouring parts, are not infrequent results of ulceration due to gummatous deposits in these parts. The posterior wall of the pharynx is frequently the seat of ulceration, due to gummata. These growths are developed in the mucous membrane and submucous tissue on each side of the median line. The resulting ulcers are of various sizes, and exhibit a marked tendency to spread, especially in debilitated subjects. The acts of swallowing and speaking are performed with pain and difficulty; there is frequent and troublesome cough, and more or less profuse sero-purulent sanious expectoration. The ulcers heal but slowly, and the contraction of their cicatrices may seriously impair the function of the throat. More or less difficulty of breathing and dryness of the throat, owing to destruction of many mucous follicles, are frequently complained of. If the mischief has extended to or from adjacent parts great loss of tissue may result, and adhesions will probably be formed, whereby the size of the cavity will be much diminished and its shape considerably altered. The Eustachian tubes may become closed, and adhesions between the velum and posterior wall of the pharynx may shut off the cavity of the nose from that of the mouth. Necrosis of the subjacent vertebræ, followed by inflammation of the spinal meninges, has also been known to result from gummatous ulceration of this part.

Ulcers caused by the disintegration of gummatous growths sometimes occur on other portions of the pharynx. These may be seated so low down as to require the laryngoscope for their detection; or the indurated edge of the ulcer may perhaps be felt by the finger. The patient complains of dryness and soreness of the throat and more or less pain on swallowing. If the ulceration extends to the larynx, breathing and speaking will be interfered with. Small ulcers may heal without giving rise to any further symptoms, but the cicatrisation of large ulcers is certain to produce more or less distortion and constriction of the cavity and impairment of its function. As a matter of course severe ulceration of the pharynx is attended with febrile symptoms and other evidences of debility.

Treatment.—This must be both constitutional and local in character. Mercury must be given for the secondary affections, and iodide of potassium for the gummata and their consequences. Inhalation of steam and warm compresses will relieve the symptoms of syphilitic angina. Ulcers should be touched occasionally with nitrate of silver or a solution of sulphate of copper. Gargles of borax and alum will also be serviceable. When the ulceration is extensive the part should be painted over with a strong solution of nitrate of silver. When the secretions are fœtid, a gargle of permanganate of potash (one part of the solution to forty parts of water) or a sulphurous acid gargle (ʒss to ℥j) should be frequently used.

DISEASES OF THE UVULA.

The uvula is a prolongation of the soft palate, from the lower border of which it is suspended. It consists of a fold of mucous membrane, enclosing muscles, aponeuroses, vessels, nerves, and various glands. Inflammation of the uvula, as a primary disease, is extremely rare. It is almost always secondary, or due to extension of the disease from the neighbouring organs as the tonsils, pharynx, or soft palate. The inflammation or catarrh of the fauces often causes the uvula to become swollen and elongated. It is frequently œdematous as a consequence of prolonged irritation. The disease generally subsides with the abatement of the primary lesion.

Elongation of the uvula often occurs and is often overlooked. Such cases are very intractable. The larynx and pharynx are in a state of constant irritation, and there is general uneasiness. There is a frequent brassy cough, and an inclination to vomit. Repeated attempts to swallow something that appears to be in the throat cause great annoyance. When the elongation is very great it interferes with breathing, owing to the uvula reaching the larynx, and the patient is often roused from sleep in a state of great alarm and breathlessness.

Treatment.—Where the uvula is congested, thick and elongated, astringent applications or gargles should be used. Bromide of ammonium (gr. xx to ℥j of water) is highly useful as a gargle. Glycerine of tannin as an application is very beneficial in relaxed uvula. Where the uvula is very long, surgical interference will be required to restore it to its normal condition.

As a sequela of diphtheria, paralysis of the uvula associated with paralysis of the muscles of the pharynx not infrequently occurs.

DIPHTHERIA.

The word literally means *skin* or *membrane*. The affection is otherwise known as putrid sorethroat or malignant quinsy. It may be defined to be a highly infectious epidemic and endemic disease, due to a specific contagion which affects the whole system, and attacks especially the mucous membrane of the pharynx and air-passages, in which parts greyish layers or patches of false membrane appear, usually containing low vegetable organisms. Other mucous membranes are liable to be attacked by diphtheria. Thus the female genital organs, the stomach, and the intestines are occasionally affected. Wounds also sometimes become covered with a yellowish semi-transparent pellicle in which microscopic forms of fungi are found. Venereal ulcers sometimes become diphtheritic.

Causes.—The complaint is highly infectious, and the infectious element does not require deleterious conditions for its development. Such conditions, however, undoubtedly favour its propagation. Other causes refer to individual peculiarities. The disease is most prevalent among those who are badly nourished, who live in unhealthy localities, and work in overcrowded and ill-ventilated places. The constitution of the patient favours the development of the disease and affects its progress. The scrofulous and cachectic are more predisposed than others. The disease often attacks those who have had scarlet fever, measles, and whooping cough, and it is sometimes secondary to inflammatory sore throat. Pregnant women generally escape, but those who are weakened by lactation or recent delivery receive the poison more readily. The disease is far more fatal in rural districts than in large towns, where many unhealthy influences abound. The disease is most common in children between the ages of three and ten years. It is comparatively rare after thirty. It occurs all over the world; in some localities it is endemic. Certain large cities, as Florence and Paris, are seldom if ever free from it.

Pathology.—It is a specific and asthenic general disease due to blood-poison. In this affection the blood is considerably altered as regards its constituents, the fibrin is notably diminished, and the white corpuscles are largely increased in number. The red corpuscles are destroyed by the poison. There is an exudation on some portion of the mucous surface of the throat, and this rapidly spreads until it involves the fauces, uvula, tonsils, and pharynx generally, and in some cases even the larynx and trachea. The process consists in the exudation of cacoplastic lymph, which at first forms a thin grey pellicle on the surface; a few layers gradually form beneath it, and thus the false membrane becomes thickened and tough. The pellicle is yellowish or greyish in colour and somewhat elastic. Treated with alcohol, with nitrate of silver, or with salts of iron, the membrane shrivels. It swells and becomes transparent with acetic acid. With pepsine, with alkaline salts, and with lactic acid it quickly softens. Hence these may be said to be appropriate local applications for diphtheria. The membrane, when removed from the pharynx, is found to consist of epithelial cells, clouded and increased in number by inflammatory proliferation. In the air-passages there is also a fibrinous growth, more or less distinctly laminated and enclosing leucocytes. This is beneath the cellular layer, which it gradually displaces. When the pellicle separates there may be a healthy surface beneath, or an ulcerated patch, or signs of gangrene. The membrane itself is liable to undergo various changes; the cells become granular and fatty, and the exudation becomes mucoid or gelatinous. Besides the cells and the fibrinous exudation, the diphtheritic membrane generally contains microscopic organisms, and many observers consider that the contagious element is contained in these bodies. The most recent observations tend to show that minute rod-like growths, the *microsporon diphtheriæ* and micrococci are generally present. The latter bodies are undistinguishable from the organisms found in connection with putrefaction.

Post-mortem appearances.—The fauces, pharynx, œsophagus, and the respiratory tract are the parts affected. In persons who die within two or three days, and in whom there are no complications, and there has been no time for the formation of false membrane, we find sanguineous congestion of the mucous membrane, of the lymphatic glands and of the internal organs. There is at first redness, and more mucus is secreted than natural. In persons who die after a week the disease results in the exudation of lymph, as already described. Erosions and ulcers are often found in places where the membrane has become detached. *Secondary lesions.*—These are numerous. Enlarged glands can be felt at the angles of the jaw and down the neck. A false membrane is sometimes found in the internal ear. Where paralysis has supervened some time before death the muscles of the arms, legs, chest, and eyeballs are found in a state of waxy or fatty degeneration. *Internal organs.*—There may be evidences of bronchitis, pneumonia, or of pulmonary apoplexy. A form of parenchymatous nephritis is a pathological condition met with in diphtheria. In patients who die within a week of the attack the kidney is in a congested state. Generally one kidney is diseased, and not both, as in scarlatina; hence the absence of dropsy and of cerebral symptoms. There is no definite morbid change in the brain or spinal cord.

Cases of diphtheria vary much in severity, and may be divided into several classes, as follows:

1. *Benignant or mild form.*—This class is most numerous both at the beginning and decline of an epidemic. The duration is from eight to ten days. Recovery takes place without any medical interference, and is generally rapid and complete. In this form there is (*a*) little false membrane (exudation); (*b*) the exudation is limited to the tonsils and pharynx; it rarely involves the larynx and trachea. The false membrane becomes loose and separates between the fifth and eighth day. There is (*c*) slight fever, (*d*) the glands at the angle of the jaw are enlarged, (*e*) there is little or no albumen in urine, (*f*) no cutaneous affection, (*g*) no paralysis.

2. *Malignant inflammatory form.*—The symptoms are those of severe cynanche pharyngea, and precede the exudation. The redness and swelling of the uvula are very marked; the exudation has often a jelly-like transparency. Pain in swallowing is great. In from twelve to forty-eight hours from the first throat symptoms tough lymph appears. The febrile disturbance is severe, but soon becomes asthenic. Death may be due to extension of inflammatory

exudation to the larynx or to the trachea in a few hours. There is much albumen in the urine.

3. *Insidious form.*—No severity in general symptoms, no marked soreness of the throat, no great swelling of the lymphatics; the laryngeal symptoms suddenly supervene, and death rapidly follows from suffocation. If the pharynx be not examined the disease is liable to be confounded with primary croup.

4. *Primary laryngeal form.*—In this variety there is exudation at first on the larynx. This seems to differ from croup only as regards the age of the patients. In one case the age was forty-five years.

5. *Asthenic form.*—The general and local symptoms at first are moderate. The pulse becomes soon rapid and feeble; the sense of illness is extreme; the lymphatics are always enlarged, but of softer consistence; the patient may either swallow well or have pain on swallowing. Death takes place in from eight to ten days from failure of the heart's action.

It must be allowed that there are no sharp lines of demarcation between these varieties.

Symptoms.—There is a period of incubation varying from a few days to several weeks. *Invasion.*—The disease sets in either insidiously or suddenly. In the insidious form the premonitory symptoms are rigors, slight febrile disturbance, general restlessness and discomfort, some amount of drowsiness, and loss of appetite. The patient complains of tickling cough, and there is hoarseness of voice. In many cases these symptoms last for three or four days, before the true symptoms and signs of diphtheria manifest themselves. On the other hand the disease may develop suddenly and without warning. In these cases stridulous breathing and spasmodic dyspnœa suddenly supervene. On inspecting the throat, the mucous membrane is found covered with tough cacoplastic lymph. The false membrane is seen on the tonsils, pharynx, and the air-passages. Its nature has been already described. In a few cases the patient is extremely prostrated from the first, and death takes place on the first, second, or third day of the attack from the violent effects of the poison and before any exudation takes place.

The other *special symptoms* include (*a*) prostration of strength, (*b*) albuminuria, (*c*) cutaneous eruptions, (*d*) change of temperature, (*e*) diphtheritic paralysis, (*f*) and enlarged glands.

Prostration of strength.—This symptom varies in intensity in different cases. As stated already, some patients die from the primary effects of the poison. In others again, there is time for the formation of false membrane and death follows. In a third class prostration is followed by local manifestation of false membrane and other symptoms.

Albuminuria.—This is a most common complication in diphtheria. Its presence may often be detected from the second to the twelfth day. It is very persistent and often lasts for five or six weeks. In a few cases it is intermittent and appears and disappears several times in twenty-four hours. It occurs in about one third of the cases of diphtheria. The albuminuria which complicates diphtheria is not the same as occurs in scarlatina; in the latter it is associated with dropsy. Albuminuria in the former complaint does not portend any renal disease. Its possible causes in diphtheria are: 1. Poisoned or altered state of the blood. 2. Rapid waste of tissue. 3. Profuse discharge of effete matter by the kidneys. 4. Ingestion of food which may not be assimilated. 5. Deranged respiration as in pneumonia. 6. Death agony. 7. Congestion of the lungs and asphyxia due to the presence of false membrane. 8. Overstrain of the kidneys due to extra work and subsequent congestion. 9. Weakness or feebleness of the renal functions through general debility.

Cutaneous eruptions.—These are not always present. When they exist they are often mistaken for scarlatina. Unlike scarlatina, they do not end in desquamation. Ecchymotic spots indicate great danger. The eruptions are sometimes vesicular, sometimes like urticaria, and in some cases they resemble rubeola, roseola, or erythema.

Change of temperature.—A very high temperature is always a sign of danger. In rapidly fatal cases the temperature may remain normal or only slightly raised.

Enlarged glands.—Enlargement of the glands at the angles of the jaw is often the first indication of diphtheritic poisoning. The enlargement is due to the general disease, and not to local throat mischief.

Paralysis.—Diphtheritic paralysis occurs in various forms and degrees. Paralysis is sometimes also associated with or is a sequel of typhoid fever, relapsing fever, smallpox, and pneumonia. Such paralyses are generally of a peripheral origin, and have a tendency to end in recovery; but in protracted cases the paralysed muscles waste from long disuse. In diphtheria, paralysis or loss of nervous power sets in usually about a week or ten days after the subsidence of the original complaint. Cases sometimes occur in which the paralysis sets in during the height of the disease. When paralytic symptoms appear some time after the termination of the disease they are more severe, more protracted, and more generalised; but when they set in during the course of the disease they are usually transient, slight, and limited. The palate, pharynx, or the œsophagus are the parts most commonly affected, but the loss of nervous power may be general. Patients may die in such cases, but death is seldom distinctly due to paralysis. The signs of paralysis are: 1. Slight difficulty in swallowing liquids, or a sort of choking cough on attempting to eat, due to the contact of food with the larynx. In some cases the fluid returns through the nose. 2. Impaired or snuffling voice. 3. The eyelids droop or are half closed. 4. The mouth is paralysed, so that the saliva dribbles from it. 5. The speech is often affected; it is slow, difficult, or even stammering. 6. The lower limbs are paralysed first, then the upper. 7. The heart may become paralysed, and death is sudden. 8. The respiratory muscles may become paralysed, and congestion of the lung follows. 9. The bladder and rectum may suffer, and urine and fæces may escape involuntarily. 10. The sense of sight is that which is most frequently involved in paralysis. There may be squinting, imperfect sight, or other visual disturbances. Amblyopia, presbyopia, and myopia are noticed.

There is on record the case of a student who had loss of vision of the right eye, and as sight returned tingling and want of power in the feet came on; the right foot became first affected, then the upper extremities below the elbows. There was also tingling in the hands, and a feeling as if something was placed between the fingers which they touched. There was no albumen in the urine, and he recovered after some months.

Diagnosis.—Diphtheria and croup are not the same disease. There is no evidence to show that croup is more than local, that croup is contagious, that croup occurs as an extended epidemic, that croup affects many adults, that in croup there is albumen in the urine, and that in croup symptoms of disordered innervation follow. Diphtheria cannot be declared with certainty to exist until the membranous deposit has extended to the respiratory passages.

Diagnostic table between diphtheria and true croup.—The distinctive characters have reference to (1) age, (2) sex, (3) constitution, (4) nature of illness, (5) ætiology, (6) local or general character of the disease, (7) onset of the attack, (8) seat of mischief, (9) throat, (10) false membrane, (11) result of exudation, (12) complications, (13) sequelæ, (14) characteristic symptoms, (15) duration.

I. **Diphtheria.**

1. Young, between three and six years, and adults.
2. Both.
3. Generally weak.
4. Highly contagious—epidemic, endemic.
5. Not inflammatory, specific blood-poison.

6. It is a general disease, local manifestations being subsequent or secondary.
7. Gradual.
8. Soft palate, pharynx, œsophagus.
9. Sore throat from the first. The disease may extend to the whole of the respiratory tract.
10. Begins on tonsils or throat and extends downwards.
11. Leaves a raw bleeding surface or scar.
12. Albuminuria, enlarged glands.
13. Paralysis. Impaired voice.
14. (*a*) cough not violent, (*b*) breathing not affected at first, (*c*) breath fœtid.
15. Forty-eight hours to fourteen days.

Croup.

1. Young only.
2. Both.
3. Indifferent.
4. No evidence of being infectious; not epidemic.
5. Acute inflammation of the trachea, larynx, or both.
6. Inflammatory disease; local manifestation primary.
7. Sudden.
8. Larynx, trachea (throat after extension).
9. No sore throat visible from the first, or until the disease extends upwards.
10. Begins in the windpipe.
11. No scar, only a red surface.
12. None.
13. None.
14. (*a*) cough hoarse, loud, ringing; (*b*) breathing peculiar, loud, sonorous; (*c*) odour of breath natural.
15. Uncertain.

Prognosis.—No case is unattended with danger. During the first three or four days there is danger if the larynx be implicated and false membrane deposited. A laryngeal quality in respiration is, therefore, a grave sign. After the first week, even where the symptoms may be slight, a very rapid and feeble pulse or an intermittent pulse, vomiting, bleeding from the nose, abundant albumen in the urine, and delirium, all give rise to apprehension, and the younger the patient the worse is the prognosis. In children the power of resisting depressing influences is very small, and in infancy and childhood the larynx is very narrow. The prognosis is favorable if the false membrane is deposited after the seventh day, if the patient can take and digest food and the heart's action is strong.

Cold and damp weather increases the mortality. In some epidemics, where only the pharynx is implicated, recoveries are abundant. When the nasal passages are attacked fatal hæmorrhage is not unfrequent. In favorable cases the disease runs its course in from eight to ten days. In cases of a malignant type death may occur as early as the second day, or may take place later on from hæmorrhage and exhaustion, or from general asthenia, or from laryngeal complications.

Treatment.—The treatment of diphtheria may be described under three principal heads: (1) hygiene, (2) therapeutics, and (3) diet. In every case the system must be supported, as the disease is characterised by prostration. All agents which have a depressing effect should be scrupulously avoided. If the patient passes satisfactorily through the first eight or nine days a spontaneous recovery will almost certainly follow. Convalescence will soon be established, and tonics such as quinine, iron, and strychnia will be found very useful.

Hygiene.—The patient should be kept in bed and clothed in flannel during cold weather; the air of the room should always be kept warm. The temperature should be about 64°. The windows should be kept open whenever the weather will permit, in order to relieve difficulty of respiration. Good ventilation is very important, but draughts of air must be scrupulously avoided. If tracheotomy be needed, the air of the room should be kept warm and moist. Even in cases where there is no throat complication the same precaution is equally necessary, for a paroxysm of throat affection may manifest itself at any time.

Diet.—Milk, beef tea, and wine are necessary in all cases. Such diet is needed as can easily be assimilated. It is useless to push alimentation beyond certain limits. During the acute stage of the disorder the patient loses flesh and strength very rapidly, as shown by rapid emaciation and by the albumen which is passed with the urine. Diphtheritic patients generally show an aversion for food. The sight of food and even the mention of it bring on nausea, and if food be taken it is often rejected at once by vomiting. Pepsine in any form is highly useful. Raw meat and fresh meat juice will sometimes keep patients alive. Eggs and milk may be given if the patient can retain them. Alcoholic stimulants are generally necessary in order to support life during the most critical periods of rapid emaciation and extreme prostration. Brandy, diluted with iced soda-water, may be given in doses varying with the age. It should be freely exhibited for many days, and it may be combined with tea, coffee, or meat juice. If the stomach is unable to retain food or stimulants, rectal alimentation may be employed, and thus complete rest will be given to the stomach. After a day or two, or after a few hours' trial of rectal alimentation, renewed attempts by the mouth may be made, and these may be assisted by the administration of various gastric sedatives, as creasote, carbolic acid, oxalate of cerium, or nitrate of bismuth. If in spite of all these remedies the nausea is very distressing, a mustard plaster to the pit of the stomach, or chloroform and tincture of opium sprinkled over cotton and applied to the pit of the stomach, may afford relief. Some patients are relieved by one-sixth of a grain of morphia given every three or four hours. The hypodermic injection of morphia is another method of allaying nausea and vomiting; drop doses of dilute hydrocyanic acid are sometimes beneficial.

Medicines.—There are three purposes for which drugs are usefully employed in diphtheria. These are: 1. To cure or relieve the general disease. 2. To relieve the urgent symptoms. 3. To remove the exudation product or to aid the expulsion of the false membrane from the air passages. The attainment of the first two objects can be promoted by attention to hygiene and diet, as already alluded to; to fulfil the third indication various remedies and topical applications are in use. If the exudation be such as to obstruct the larynx, trachea, or the bronchi, an emetic may be tried, but should it fail tracheotomy must be performed, in order to prevent suffocation and to save life. Emetics should be very carefully administered or else avoided, in advanced stages of the disease, or at any stage attended with extreme prostration. Violent efforts at vomiting will prove very exhaustive and lessen the chance of recovery. Another disadvantage in the use of these remedies lies in the fact that if given before the exudative stage has ended they afford only a temporary relief, for the false membrane ejected by vomiting is speedily replaced by a new deposit. For diphtheritic patients an emetic, if given, should be of a nature to act quickly and certainly; it should not leave any depressing after-effects, and if it fail to produce vomiting it should not set up irritation of the bowels and lead to diarrhœa. The safest drugs are ipecacuanha, which may be combined with ammonia, and sulphate of zinc. The hypodermic injection of apomorphia, in doses varying from one twenty-fifth to one-sixth of a grain, has been tried, and found to act better than ipecacuanha or sulphate of zinc. The injection is certain and quick in its action, and is not attended with nausea. Jaborandi has been tried, combined with pepsine and hydrochloric acid; the copious salivation helps to detach the membrane.

With regard to general remedies, the dialysed iron and the tincture of the perchloride are often useful. Bromine and its compounds, chlorate of potash, quinine, strychnia, and the salicylic acid, membrane. Simple ulcers, resembling those observed in the stomach, are very rare.

Symptoms.—In addition to the symptoms of œsophagitis there are others which mark the stage of ulceration. The patient complains of a localised pain of a burning character, and felt in front at the top of the sternum, or in the præcordia, or behind between the scapulæ. Deglutition is painful, difficult, or even impossible, owing to irritation and spasm. On auscultation the sound of food passing down the tube is prolonged and less distinct than in health. In some cases dysphagia is very marked, and the patient soon emaciates and dies.

Terminations.—Small ulcers get well without leaving any trace behind. The extensive and deep ones, if they heal, give rise to cicatrices, and consequent contraction, and stricture of the œsophagus. Sometimes they perforate the trachea and lead to a fistula, or may open into an artery and cause hæmorrhage. A communication is occasionally established between the œsophagus and the bronchi (generally the left), or between it and the pleura or the pericardium.

Treatment.—To support the patient by nutritious diet, either by the mouth or through the rectum, is the chief object to be aimed at in the treatment of ulcers of the œsophagus. Locally, various applications, as tannate of glycerine, nitrate of silver, and borax have been applied. Ice may be freely given.

STRICTURE OF THE ŒSOPHAGUS.

Œsophageal stricture is a narrowing or almost complete closure of the gullet. The stricture may be functional or organic.

Functional derangements may give rise to temporary narrowing, as occurs in diseases of the brain, in intemperance, in hysteria, and in cases of pressure on the œsophageal nerves. Organic stricture may depend on (1) protrusion of new growths within the tube, either separate or from within the walls of the œsophagus, as fungous growths, syphilitic gummata, or malignant tumours, as epithelioma or colloid cancer; (2) structural changes in its walls, as thickenings and cicatricial contractions from extensive ulcers or wounds and corrosions. It may be the result of chronic inflammation leading to hypertrophy of the muscular and intermuscular tissues. The narrowing from compression may occur in various ways. There may be enlargement of the thyroid or lymphatic glands, dislocation of the hyoid bone, exostosis of the vertebræ, abscess or tumours between the trachea and the œsophagus, carcinoma of the lungs or pleura, aneurysm, diverticula of the œso-

DISEASES OF THE ŒSOPHAGUS.

INFLAMMATION OF THE ŒSOPHAGUS (ŒSOPHAGITIS).

Inflammation of the œsophagus is extremely rare as a primary disorder, but it may occur as a secondary affection, and as a result of catarrhal inflammation of the throat. In children catarrhal stomatitis may extend downwards and cause œsophagitis. Two other affections, viz. diphtheria and croup, are known to extend to the œsophagus. Inflammation of the œsophagus may be due to direct injury or irritation by foreign bodies, or irritating or corrosive substances, such as acids, alkalies, and boiling water.

Pustular inflammation of the œsophagus has been found in a few cases of smallpox.

Symptoms.—There is very little sensibility of the œsophagus in the normal state; in severe cases of inflammation there is pain in the course of the œsophagus, or the pain and heat are felt deep in the chest, or between the shoulder-blades. Saliva dribbles from the mouth. Deglutition is painful and difficult; the food is rejected mixed with mucus, or with blood, or membranous shreds and pus. There may be great thirst and slight fever. Bloody mucous expectoration is often brought up. The condition may end favorably, or in ulceration, or in stricture of the œsophagus. Stricture generally results in cases where the œsophagitis is due to the passage of some irritating or corrosive substances. There is at first inflammation, followed by ulceration, resulting in a permanent thickening of the coats of the tube.

Treatment.—The patient should make no attempts at swallowing, but a little ice placed in the mouth gives relief. The pain may be soothed by the hypodermic injection of morphia, or by opiate enemata. The state of the bowels should be attended to, and an enema of castor-oil may be given to relieve constipation. Rectal alimentation is the most suitable plan of feeding the patient.

ULCERATION OF THE ŒSOPHAGUS.

Causes.—It may be the result of acute inflammation, or of smallpox pustules, or be due to syphilitic or scorbutic lesions, or to local irritation of destructive agents, or to perforation, as from swallowing pointed or angular bodies, which become fixed in the œsophagus, and not being dislodged cause erosion and ulceration of the mucous

Treatment.—The injection of food by the rectum in cases of organic stricture is the only means of prolonging life. In spasmodic stricture the inhalation of chloroform often gives relief. In cases of cancer, the passing of a bougie should never be attempted. In other cases, slow and gradual dilatation often proves valuable. In syphilitic cases, iodide of potassium should be given in large doses and for long periods. It is worthy of notice that syphilitic lesions of the œsophagus are sometimes followed by cancerous formations. In hysterical cases the health should be improved by tonics. Narcotics, especially belladonna, and antispasmodics, as valerian, musk, and assafœtida are useful.

Dilatation of the Œsophagus.

This condition may affect the whole tube, or may be partial and confined to a part. In the partial form the wall of the tube forms a sort of hernia, or sacculation, on one side. These diverticula are usually formed by the dilatation of all the coats, but sometimes by the dilatation of the mucous membrane alone.

The enlargement may be due to lodgment of a foreign body, in which case the tube is dilated, the portion below being narrowed. Dilatation may also arise from stricture. If general, it may be due to muscular paralysis, to chronic catarrh, or to shrinking of the bronchial glands.

Morbid appearances.—The tube may be dilated to the size of an arm. The walls generally are hypertrophied. When due to constriction, the dilatation is most considerable just above the narrowed part. Diverticula generally form near the bifurcation of the trachea.

Symptoms.—When general, there are no marked symptoms. In partial dilatation regurgitation of food with mucus takes place, and the food is alkaline.

If the dilatation is due to stricture of the œsophagus, it will be observed that the food, after it has been swallowed, is much longer retained than formerly. There is often a sense of fulness and discomfort in the dilated part after taking food, and the patient is relieved by vomiting. When pouches are formed the retention and decomposition of food give rise to some fœtor of the breath. After the food is swallowed a swelling may appear, which by pressure interferes with respiration and circulation. When dilatation exists auscultation reveals more or less change in the peristaltic action during the passage of food. In general dilatation, the food passes down the gullet suddenly as if dropped at once into the stomach. When a pouch exists a bougie will sometimes enter it, while occasionally it will pass freely down the tube.

Treatment.—The primary disease must be treated. Fluid food should be given in small quantities at a time.

MORBID GROWTHS OF THE ŒSOPHAGUS.

Carcinoma chiefly affects the upper and lower thirds of the œsophagus, and is somewhat rare in the middle of the gullet; it is rapid in its progress, and the cervical glands are affected.

It is the most common form of morbid growth. It commences in the submucous tissue and extends to other coats, and may involve other organs.

Fibroid tumours are very rare: they are met with either in the form of hard growths in the submucous tissue, or as pedunculated polypi about the level of the cricoid cartilage.

Post-mortem appearances.—When the growth (cancer) continues for some time the gullet becomes hypertrophied and dilated above it. In the distended portion food accumulates, and causes irritation and ulceration. The cancerous growth softens and ulcerates, and may cause perforation of the trachea, bronchus, or aorta.

Symptoms.—Small fibroid tumours cause no symptoms; larger ones may cause symptoms of stricture and hæmorrhages. Carcinoma is not easily mistaken; cachexia and difficulty of swallowing gradually supervene; lancinating pains shooting backwards and into the scapula, nausea and retching, and fragments of cancer coughed up make the diagnosis certain. The patients are almost always above middle age. The symptoms of stricture rapidly increase in severity. The patient continues to emaciate, and there is enlargement of the lymphatic glands. One or both recurrent laryngeal nerves are generally implicated, and there is paralysis of the vocal cords. Syphilitic disease of the œsophagus, on the other hand, never causes pressure on these nerves.

Duration.—Cancer of the œsophagus has been known to terminate in death in six weeks, and its duration is always short.

Treatment of the symptoms.—Opium is the main remedy. The patient's strength should be sustained by rectal alimentation. Bougies should not be used when the diagnosis of cancer is certain.

DISEASES OF THE STOMACH.

DERANGEMENTS OF THE STOMACH—DYSPEPSIA.

Gastric derangements refer to—

1. *Perverted sensations.*—In a state of health we are unconscious of the process of digestion. After food there are feelings of comfort and satisfaction. In indigestion the sensations are altered. The changes vary from a mere feeling of discomfort or weight and oppression at the pit of the stomach or in the abdomen to a severe colicky pain (spasm). Another class of sensations includes a feeling of loathing or disgust at the sight of food, and a feeling of emptiness, with severe craving for food. Other morbid sensations are acidity, heartburn, a sense of burning over the chest or in the epigastrium, and pain in a circumscribed spot, associated or not with tenderness over the pit of the stomach.

2. *Perverted muscular action.* — Various movements of the stomach and intestines are interfered with. In the stomach these changes give rise to vomiting, either directly or some time after taking food, with or without cramps in the stomach. Besides vomiting there are acid eructations and hiccough, and frequent passing of flatus. Interference with the movements of the intestines may give rise either to diarrhœa or constipation.

3. *Derangements of the gland-follicles.*—These give rise to perverted secretion, and vomiting is a common result of this abnormality. The food may be ejected at once, or may be in a state of active fermentation, and after a time rejected. Altered gastric secretions very often give rise to eructation of acrid, bitter, or at times a tasteless fluid, as in pyrosis. Blood is sometimes vomited or passed by stools.*

Other symptoms refer to affections of other parts through reflex influence or deranged action elsewhere. The breath may be foul, the tongue furred, or altered in colour, size, and general appearance.

The relation subsisting between the digestive organs and the body generally accounts for various other phenomena associated with derangements of the stomach. These are: sympathetic

symptoms of headache, pain in the back or in the right shoulder; others, again, are referable to the brain, heart, lungs, liver, kidneys, and skin. Those symptoms which are manifested by the system generally refer to cachexia and wasting. Confirmed dyspeptics have a peculiar sallow and muddy-looking skin, and are often decidedly anæmic. Thus the concomitants of gastric disorders are as multifarious as those of hysteria.

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* Many of the symptoms of disordered digestion have been referred to under the heading "Symptomatology," in Vol. I. To avoid repetition the reader is referred to pp. 93—103 of that volume for a description of Anorexia, Flatulence, Pyrosis, Acidity, Nausea, Vomiting, &c.

Causes.—They are as numerous and varying as the symptoms are diverse. In many cases there is hereditary tendency; and one attack renders the patient more liable to another. *Age.*—Dyspepsia occurs most commonly between the ages of 20 and 45, and is more frequent in the female than in the male sex. The upper and middle ranks of life are most subject to this disorder. *Climate.*—It is a disorder of cold and temperate climates, and is more prevalent in the winter than in the summer. Those who live within the tropics are, however, not exempt from it. Damp weather and a moist atmosphere favour its occurrence. Other predisposing causes are sedentary occupations, as in close rooms, indolent habits, high living, prolonged study, excess of any kind, and want of fresh air. Imperfect mastication, and hastily swallowing food, owing to absence of teeth, or from habit, are common causes of gastric disorders. Violent fits of passion, anxiety, repeated disappointments, and the like slowly but certainly exert a similar effect. Exhausting discharges of any kind, as protracted hæmorrhages, leucorrhœa or menorrhagia, seminal weakness, and venereal excesses lead to a similar result.

The *exciting causes* are divisible into two classes. 1. Those which affect immediately or directly the stomach itself. They debilitate the muscular coat and interfere with the proper secretions. 2. Those which influence the stomach through the medium of other parts.

1. *Direct exciting causes.*—Irregularity or want of due caution as regards quantity and quality of diet, large doses of calomel, strong purgatives, narcotic medicines and spirituous liquors are the chief sources of mischief. Irregularity in diet includes 1. Over-repletion, as when too large a quantity of food is taken by persons with sluggish habits. 2. Ingestion of food of improper quality, such as that undergoing fermentation or decomposition. 3. Indigestible food. 4. Food taken at irregular times, sufficient intervals not being allowed between the meals. 5. [illegible], or [illegible] articles of diet and condiments and rich articles of [illegible]. Ice and cold drinks taken at dinner or at [illegible], or during periods of digestion by lowering the temperature of the stomach, diminish the solvent power of the gastric juice. In

DISEASES OF THE STOMACH.

DERANGEMENTS OF THE STOMACH—DYSPEPSIA.

Gastric derangements refer to—

1. *Perverted sensations.*—In a state of health we are unconscious of the process of digestion. After food there are feelings of comfort and satisfaction. In indigestion the sensations are altered. The changes vary from a mere feeling of discomfort or weight and oppression at the pit of the stomach or in the abdomen to a severe colicky pain (spasm). Another class of sensations includes a feeling of loathing or disgust at the sight of food, and a feeling of emptiness, with severe craving for food. Other morbid sensations are acidity, heartburn, a sense of burning over the chest or in the epigastrium, and pain in a circumscribed spot, associated or not with tenderness over the pit of the stomach.

2. *Perverted muscular action.* — Various movements of the stomach and intestines are interfered with. In the stomach these changes give rise to vomiting, either directly or some time after taking food, with or without cramps in the stomach. Besides vomiting there are acid eructations and hiccough, and frequent passing of flatus. Interference with the movements of the intestines may give rise either to diarrhœa or constipation.

3. *Derangements of the gland-follicles.*—These give rise to perverted secretion, and vomiting is a common result of this abnormality. The food may be ejected at once, or may be in a state of active fermentation, and after a time rejected. Altered gastric secretions very often give rise to eructation of acrid, bitter, or at times a tasteless fluid, as in pyrosis. Blood is sometimes vomited or passed by stools.*

Other symptoms refer to affections of other parts through reflex influence or deranged action elsewhere. The breath may be foul, the tongue furred, or altered in colour, size, and general appearance.

The relation subsisting between the digestive organs and the body generally accounts for various other phenomena associated with derangements of the stomach. These are: sympathetic

symptoms of headache, pain in the back or in the right shoulder; others, again, are referable to the brain, heart, lungs, liver, kidneys, and skin. Those symptoms which are manifested by the system generally refer to cachexia and wasting. Confirmed dyspeptics have a peculiar sallow and muddy-looking skin, and are often decidedly anæmic. Thus the concomitants of gastric disorders are as multifarious as those of hysteria.

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large a quantity of cold or warm liquid taken along with the food interferes with the proper secretion and action of the gastric juice. Long or complete abstinence from such articles of diet as are essential for the due maintenence of health and existence, *e.g.* the adoption of a purely vegetable diet; attempts to live on simple milk diet, long fasting, insufficiency of food and sudden changes of diet directly produce indigestion. Other causes are: 1. Diminished muscular power of the stomach as in displacement of the organ. 2. Dilatation of the stomach. 3. Feebleness, as want of muscular or nervous tone of the stomach. 4. Habitual overloading of the organ. 5. Various morbid states of the blood, as in Bright's disease, diabetes, gout, fevers, and even anæmia. Gastric disorders are also due to abnormal fermentations which take place secondarily and under various conditions. The abnormal fermentation may be due to morbid conditions of the stomach, alterations in the quantity or quality of the gastric juice, or in the mucous secretion. It is also due to the presence of atmospheric air, and of various ferments.

Indirect causes.—These operate on the stomach through the medium of other parts. An example of these is active mental or physical work before or after a full meal. It acts by depressing the nervous energy of the stomach, and by diverting the blood from the gastric vessels to other parts. Good digestion depends largely upon mental conditions and influences. Hence it is of great importance that pleasant topics of conversation be chosen at table, and that all subjects of a contrary nature should be avoided.

Indigestion is sometimes consecutive to other affections. Thus it may arise from morbid states of the mucous membrane of the stomach or of its secretions. It is common in gastric catarrh, in which there is an increased secretion of mucus with diminished secretion of the gastric juice. The increased mucus has the power of neutralising the effects of the gastric juice. It also acts as a ferment, and thus promotes further decomposition, hence catarrh is a common and most fruitful source of gastric disorders attended with fermentation. Other causes are, obstruction to the circulation in other organs, as in diseases of the heart, lungs, liver, kidneys, or uterus. In such cases a slow and painful digestion is a frequent symptom. The food being detained for a long time in the stomach sets up further irritation, and undergoes various fermentative changes. Various organic diseases of the stomach also give rise to gastric disorders. These are:—1, gastric ulcers; 2, carcinomatous or other growths constricting the pylorus; 3, degeneration of its secreting glands; and 4, degeneration of the gastric vessels.

For convenience of description, dyspepsia may be divided into simple asthenic or atonic, and irritative dyspepsia. The *simple or* *atonic disorder* proceeds from (1) simple diminution of the functional power of the stomach, (2) impairment of the proper secretion of the gastric juice, (3) weakness of the muscular contractility, (4) languid circulation in the vessels of the stomach.

Symptoms.—These may set in suddenly, as after a meal consisting of rich or highly-seasoned food. They are common in children, but adults are not exempt from attacks. The symptoms often follow immediately after a full meal, but they may appear some hours afterwards and be attended with vomiting. They often arise in persons who have taken food soon after prolonged muscular exertion, or while subject to some powerful emotion. Exposure to cold also gives rise to an attack. Such patients feel depressed and languid; they experience uneasy sensations and feelings of oppression at the pit of the stomach, or fulness or weight at the epigastrium. Eructations, sometimes acid and sometimes fœtid, and cardialgia or heartburn are common. The breathing is oppressed from pressure of the distended stomach upon the diaphragm. There is often severe pain, with cramp-like sensation in the epigastrium, but no tenderness. The pain is increased on coughing, and also after taking cold fluids. There is great thirst. The tongue is dry, furred, or moist and slimy, and is often pale, flabby, and indented by the teeth. The taste is perverted. There is occasional eructation of foul gases, and pyrosis, chiefly after a meal. The patient also suffers from headache, from irregular or excited action of the heart (palpitation), and giddiness. Sometimes there is nausea with vomiting, or a sense of constriction round the throat. The patient often experiences indigestion at night; he either awakes with severe headache or frightful dreams, or suffers from violent pain in the stomach or bowels. In children, convulsions are common. In a short time after the pain begins the pulse becomes weak or soft, sometimes slow; the skin is cool and moist; that of the extremities is cold, while the abdomen is hot. Shivering often occurs. Vomiting is common at night, or after waking in the morning, and the stomach is thus freed of its irritating contents. The vomited matters consist of undigested food, or of mucus or bile. After vomiting the patient feels relief, but for several days the appetite is more or less impaired. The digestion is weak, the tongue continues coated and furred, the breath is offensive, and there is some amount of debility. The urine is generally scanty, and of an orange-red colour. The specific gravity is high. The urinary acids and the pigments are [illegible] present. The bowels are sometimes regular, but more often constipated. In disorder of the stomach all these symptoms are soon relieved or mitigated by regularity of diet; but when dyspepsia is due to mal-nutrition they cannot be thus got rid of. In brain-affections there are other symptoms referable to the disordered state of the functions of the nerve-centres and connected with the special senses. In gastric disorder, where vomiting does not occur, the undigested matters pass into the intestinal canal; the patient suffers from great distress and swelling in the abdomen, and there are often severe colicky pains followed by diarrhœa. In a majority of cases the stools are scanty and dry.

Chronic dyspepsia.—Another form of gastric disorder is known as chronic dyspepsia. It generally occurs in cases where the acute form has recurred frequently, or has been often neglected. The symptoms consist of sensations of discomfort referred to the stomach, impaired or fastidious appetite, slow and difficult digestion, and more or less habitual constipation. The patients are generally out of health, and they suffer from uneasiness and uncomfortable sensations while digestion is going on. There is a sense of weight and fulness in the abdomen, and pain with or without tenderness at the epigastrium. The appetite is as a rule impaired or lost. Sometimes the patient feels desire for food, but when a little has been taken it produces great discomfort. In other cases the sight of food produces loathing. The food, even if proper in quantity, is digested very slowly and imperfectly; it undergoes fermentation and decomposition. Bile is improperly secreted, and digestion is often delayed, and flatulence and nausea are very troublesome in the intervals between meals. The stools are irregular, most commonly scanty and dry, and often of an unhealthy colour and offensive odour. The tongue is generally furred, the breath offensive, and the throat painful or sore. Yawning and a feeling of heaviness and disposition to sleep soon after food are common. The patient often complains of a sense of weight, and of acrid or acid eructations.

As the disorder continues the appetite becomes more and more deranged, flatulence is more troublesome, the mouth is clammy, and the tongue furred, especially in the morning. Pain, spasms, or cramps of the stomach frequently recur, and various other symptoms referable to the brain are also present. The patient is apathetic and forgetful, and often suffers from vertigo. He is sometimes irritable, sometimes depressed and despondent, and the ideas are confused. Vision may be defective, and there are often muscæ volitantes or specks before the eyes, and flashes of light. The hearing may also suffer, and there may be noises in the ears. These symptoms may be due to weakness of the nerves, or to the extension of irritation from the throat along the Eustachian tube to the internal ear, or to some obstruction in the canal. The face is pale. There is a further progress. In many cases the cause can easily be removed. With this object we have first to look to the various mechanical operations which occur in the passage of the food from the mouth into the stomach. We should see that the teeth are in good order and condition, and that the processes of mastication and insalivation are properly conducted.

In the acute asthenic form the first indication is to remove the cause. If this be some irritative material contained in the stomach, an emetic of sulphate of zinc or ipecacuhana may be administered. Mustard with hot water, or tepid water with common salt may also be tried. Irritating the fauces by means of a feather or with the finger will sometimes provoke vomiting. Attention to the diet is all-essential. It should be regulated as regards food, drinks, and special idiosyncrasies. It should be wholesome and digestible, taken in small quantities, with sufficient intervals between the meals. All articles of diet which do not agree with the stomach should be scrupulously avoided. All rich and highly-seasoned dishes are injurious. Those articles of diet which are most readily digestible are oysters, game, venison, and chicken. These should be well cooked and properly masticated. Arrowroot, or sago or tapioca, milk, and eggs are for some patients preferable to any other kind of food. Fish and ripe fruits agree with some dyspeptics who have a difficulty in digesting other articles of diet. It is often necessary to keep the patient on light diet for some days. Mixtures of different kinds of food are generally injurious. Strong alcoholic beverages in any form and in large quantity are inadmissible. Fermented liquors, beer especially, soon undergo acid fermentation and seldom agree with dyspeptic patients. Old whisky or brandy, well diluted, is the best form of stimulant, and is useful in loss of appetite and after fatigue and where the digestive power is weak. Pure spring water or toast-water or seltzer or other alkaline mineral waters may be taken according to circumstances. Tea and coffee, either when too strong or taken in large quantities, are always injurious. The temperature of the fluid is an important point. We are well acquainted with the fatal effects of sudden draughts of cold water taken immediately after active exercise or whilst the body is perspiring.

In the experiment on St. Martin, the introduction of water at the temperature of 55° into the stomach reduced the temperature of the organ from 98° to 70°. The shock which the constitution receives from the sudden depression of the temperature of vital organs paralyses other vital movements. Hence the use of ice and iced drinks during and after dinner, or while digestion is going on, is highly injurious. Ices have the effect of lowering the vital tone of the stomach. When taken in great moderation, and when there is no fatigue, their effects are salutary, provided that a healthy reaction be induced.

In chronic dyspepsia fermentative changes often occur. Dietetic management is a matter of great importance. Such food as will readily dissolve in the stomach, leaving only a small amount undigested to pass through the pylorus, should be selected. Bread and fermented liquors are most prone to undergo additional fermentation, and they should be studiously avoided. The kinds of food may be thus generally arranged in the order of digestibility: the albuminous, the gelatinous, the amylaceous, and the saccharine. Milk is a most nutritious aliment. It may be given in these cases either alone, or with sago, boiled rice, or arrowroot. Boiled milk and lime-water often prevent vomiting, and the lime-water acts as an antacid. Mutton broth, freed from fat, raw beef juice, and calf's-foot jelly, are good nutritive aliments. If gastric ulcer be suspected, stimulants should be avoided.

Dyspeptic patients should always take rest for a short time after eating. Bodily or mental exercise and cold bathing soon after food are injurious; the former drives the nervous energy and the blood from the stomach and intestines, while the latter causes congestion and oppression of these viscera. Ease of mind and hilarity promote digestion; whereas anxiety, grief, and envy impede it.

The next important indication is to give immediate relief to the most urgent symptoms, as vomiting, acidity, flatulence, cramps, constipation, &c. Vomiting is relieved by rest to the stomach, or by giving small quantities of aromatic water, or a tablespoonful of iced milk every half hour. Hydrocyanic acid, bismuth, and effervescing mixtures are also serviceable. A mustard plaster over the stomach will often check vomiting. Bicarbonate of soda is very useful for increasing the secretion of the gastric juice. It should be given before food. Attention to the bowels and to the function of the liver is essential.

In dyspepsia with habitual constipation, aloes with nux vomica and belladonna, or rhubarb and magnesia, or enemata of soap and warm water, are useful; but drastic purgatives should be avoided. Extract of belladonna in doses of one quarter of a grain is useful if the dyspepsia be associated with constipation. Podophyllin, euonymin, and iridin, are more or less powerful hepatic and intestinal stimulants, and are often useful in cases of dyspepsia. Diarrhœa if moderate is salutary, and therefore need not be interfered with; should purging be very frequent and copious, astringents with opium may be given. Opium should, however, be used with caution. It is useful if the patient is purged immediately after taking food, and the stools contain half-digested matters. It is also useful in combination with nux vomica.

Other urgent symptoms, as heartburn, are best relieved by those drugs which regulate the gastric secretions. The heartburn is due to excessive acidity, and may be relieved by alkalies, as bicarbonate of soda. If constipation is present magnesia and rhubarb, with carminatives, are useful. The effect of the alkalies is only palliative; they may be combined with vegetable bitter infusions. Alkalies are often useful as sedatives to the stomach, and they thus relieve the pain. When heartburn is attended by rancid or insipid eructations mineral acids are serviceable. Flatulence with offensive gases may be checked by the same remedies. Pain and cramp-like sensations may be relieved by sinapisms, or large linseed or bread poultices to the abdomen or to the epigastrium. Turpentine stupes or stimulating liniments over the epigastrium are often employed with benefit. The pain after food may be relieved by those drugs which have a sedative action, as trisnitrate of bismuth, hyoscyamus, hydrocyanic acid, belladonna, and creasote. Hypodermic injections of morphia will very often relieve the pain. Where flatulence is present bismuth with vegetable charcoal, or a few doses of sodæ bicarbonas with infusion of vegetable bitters, and tonics, as quinine, strychnia, and iron are the best remedies. Sulpho-carbolate of soda and carbolic acid give considerable relief in flatulent distension unaccompanied by pain or other dyspeptic symptoms. If vomiting continues creasote or bismuth, or effervescing draughts of bicarbonate of soda with citric acid may be tried.

Various other symptomatic disorders consequent upon dyspepsia often require treatment. Where palpitation is frequent and the pulse is intermittent, pills made of camphor, ipecacuanha, and henbane, or of nitrate of silver with henbane, afford relief.

In chlorotic patients sulphate of iron with aloes should be preferred. Other important consequences of dyspepsia are the disorders of the liver and biliary functions. For pain and tenderness in the hepatic region leeches may be applied near the epigastrium or round the anus. Alterative medicines, as small doses of blue pill followed by aperients may be tried. The dilute nitromuriatic acid is often useful. Podophyllin, euonymin, and iridin have already been referred to. In protracted cases of dyspepsia eruptions on the skin often occur. Affections of the kidneys and bladder and symptoms of gout often appear in the course of chronic indigestion. In such cases non-stimulating cooling diet and alteratives are required. Anorexia may be treated by vegetable bitters, as gentian, quassia, or calumba, with aromatics and alkalies.

In chronic dyspepsia with defective secretion, pepsine, mineral turpentine. Pain may be relieved by the hypodermic injection of morphia or by hydrate of chloral. For the acidity alkalies, as magnesia, soda or lime-water are very useful. They may be combined with bismuth. Hyposulphite of soda in thirty-grain doses, with vegetable bitters, creasote, and carbolic acid, have all been recommended for the relief of the acidity and other distressing symptoms. Cod-liver oil may be given if the patient can tolerate it.

(2) Contraction of the stomach may be either general or partial. When general the organ is uniformly reduced in size. The affection is rare, and when it occurs is most frequently the result of inanition or long-continued abstinence from food, as in cases of disease of the œsophagus or of the cardiac orifice of the stomach. Excessive and long-continued vomiting is another cause. As a result of cancer or ulceration in the lesser curvature the stomach is generally reduced in size, owing to the approximation of the two orifices. The contraction may be partial, and is then due to puckering of the coats as occurs in cicatrization of an ulcer. Where the contraction is limited to the pyloric region hypertrophy of the muscular coat of the stomach takes place. In all cases of contraction the symptoms are those of cardiac obstruction. There is great difficulty in swallowing food, and vomiting follows the effort. The appetite is good, but the patient cannot take enough to satisfy it. The food may remain in the œsophagus and set up putrefaction or fermentation. Death is due to inanition.

Treatment.—Attempts must be made to relieve the symptoms. Food should be given in a liquid and concentrated form.

NEUROSES OF THE STOMACH.

These include gastralgia, spasm, hyperæsthesia, and nervous vomiting.

Gastralgia signifies pain in the stomach, a symptom which is met with in a variety of morbid conditions.

Causes.—It is due to a morbid condition of the nerves supplying the stomach, or to some affection of the ganglia or the plexuses. It is a common symptom of dyspepsia, anæmia, and chlorosis. Sedentary habits, mental anxiety, and severe losses of blood are predisposing causes. In acute erythematous gastritis a burning painful sensation is felt almost immediately after taking food or stimulants. In so-called eczema of the stomach the pain is severe, and comes on two or three hours after food, though temporarily relieved by eating. In disordered and profuse secretion of the stomach the pain is severe, and also occurs some time after food.

enforced. Sea bathing may be recommended. The patient should wear flannel next the skin and be careful to avoid exposure to chills. In all cases after relief has been obtained subsequent treatment must be directed to prevent a return of the disorder. Cases of dyspepsia due to pathological states and their consequences require careful investigation into the true nature of the lesions. In anæmic and chlorotic cases ulcer in the stomach sometimes occurs.

HYPERÆMIA OR CONGESTION OF THE STOMACH.

This condition is not discoverable during life. It is found in cases where death has taken place suddenly while digestion is going on, and in persons who have drunk very heavily of alcohol during the last few hours of life. In valvular heart-disease hyperæmia of the stomach is often found on *post-mortem* examination.

Morbid appearances.—The mucous lining of the stomach is of a dark purple colour, the congestion being most marked at the pyloric end. It teminates abruptly at the cardiac end. The rugæ are thick and prominent and covered with a layer of mucus; extravasated blood and spots of softening are occasionally seen. The stomach is thick and fleshy and increased in weight and bulk. Under the microscope, the tubes are found to be of large size and distended with cells and granular matter, the blood-vessels enlarged, and the veins are thickened. In chronic cases, besides the anatomical changes, the secretion of acid is diminished. The formation of pepsine is also less.

GASTRITIS.

Slight inflammatory conditions of the stomach, common during life, leave no traces after death. In gastritis all the coats of the stomach are seldom or never simultaneously involved. Inflammation most commonly attacks only the mucous coat. The disease is known as gastric catarrh. The term, however, is erroneous, inasmuch as the mucous membrane of the stomach is in reality an expanded gland. Any injury to this structure leads to changes in its function which may either be lessened or altogether destroyed.

Gastritis may be either acute or chronic. Acute inflammation of the mucous membrane of the stomach may be either catarrhal or erythematous. It is an affection of great severity, and the general and local symptoms are well marked.

Causes.—Acute gastritis is most common in persons of middle and advanced life, and is more frequent in females than in males. Gouty inflammation of the stomach sometimes occurs in gouty persons when the disease suddenly disappears from the joints. Gastritis is common in cases of long-continued congestion of the mucous membrane, as in disease of the heart, emphysema of the lungs, and cirrhosis of the liver. It is also a result of direct irritation of the mucous membrane by substances which act either chemically or mechanically. Highly irritating articles of food, sharp condiments, undiluted alcoholic drinks, and some kinds of shell-fish taken into the stomach, produce more or less acute gastritis. It occurs but rarely as a result of taking mineral acids and corrosive poisons, as arsenic and corrosive sublimate.

All those circumstances which generally favour the occurrence of inflammation may lead to gastric catarrh. Thus plethora, high living, high ranges of temperature with moist atmosphere are causes of this condition. Indigestible food, and food already decomposed, or which has begun to decompose before entering the stomach may set up a process of fermentation and lead to gastritis. Too high or too low a temperature of the food, as very hot or very cold ingesta; various irritants and large doses of purgatives; various mechanical agents, as powdered glass, pieces of sharp and rough substances, as pins, or blades of knives, swallowed accidentally or intentionally; blows on the stomach and the reaction consequent upon such physical injuries are followed by similar results. A form of gastritis, generally met with in children and young persons, is known as erythematous gastritis, or gastric fever. It sometimes occurs during scarlet fever and other eruptive disorders, and during the last stage of phthisis.

As already remarked, gastric catarrh is widely different from catarrh of any other organ. During normal digestion, changes take place which in any other mucous membrane would be called catarrh. In gastric catarrh there is extension of this process beyond certain limits. There is unhealthy flow of mucus, with detachment of the epithelium, and the process is accompanied by slight general disturbance and fever. In some cases it commences with a diminution of the gastric juice, as occurs in acute fevers. This diminution of the gastric secretion favours the decomposition of the ingesta, resulting in increased secretion of gastric mucus.

Anatomical characters.—In acute gastritis the stomach is contracted and empty. The lining membrane is covered with a thick tenacious alkaline mucus; the submucous tissue is congested. The rugæ and the membrane are softer than normal and present several points of extravasation. These hæmorrhages are mostly found at the pylorus. The vessels are enlarged and congested. The gastric tubes are distended with large granular cells. The solitary glands are enlarged.

In erythematous gastritis there is no increased secretion of mucus; the lining membrane is slightly injected or paler than usual. The gastric tubes are distended with albuminous fluid or granular and fatty matter; the cells are reduced in number; casts of the tubes are sometimes met with in the contents of the stomach.

Symptoms.—These are both general and local. The disease in some cases sets in without warning; but when it attacks children, there are for a few days or hours general restlessness, nervous depression, and sleeplessness. In adults, when gastritis is of moderate severity and the result of some error in diet, the patient feels weak, dull, fretful, and may complain of prostration of strength, pain in the forehead, vertigo, intolerance of light and sound, palpitation of the heart, and disturbed vision. There is no pain in the stomach, but a sense of weight and general uneasiness in the epigastrium, with nausea, flatulence, and distension, great thirst, and dryness of the fauces. There is often secretion of watery mucus (pyrosis) accompanied with acrid eructations. The abdomen is rigid and the recti muscles tense; occasionally there is tenderness at the epigastrium on firm pressure. There is absence of appetite and loathing of food. The tongue is coated with a thick creamy fur; it may be red at the tip, or clean or dry and fissured. The breath is offensive, owing to the coexistence of oral catarrh. There is depression of spirits and disturbed sleep. If such patients fast for a day, the symptoms disappear, especially after the bowels have been relieved. Vomiting is almost always present. At first the matters vomited consist of rejected ingesta; after a time, of thick ropy tenacious mucus, mixed with acid matters, and their ejection is accompanied with violent retching. In prolonged cases bile is brought up, and is recognised by the bitter taste and by a yellow or green colour. Blood may be present in the vomited matter. The taste is perverted. The bowels are also disturbed, and there may be diarrhœa attended with colic, but generally there is constipation. The urine is scanty and high coloured. The pulse and temperature are unaffected. Generally after vomiting the patient is much relieved. When the inflammation extends to the duodenum jaundice may occur.

Acute gastritis is a rare affection. When due to irritant poison the local symptoms are at once developed, and, if the poison be of a corrosive nature, are most intense. There is severe burning or tearing pain at the pit of the stomach, and extending to the lower part of the chest in front, and to the spine and between the shoulders behind, and rigidity and retraction of the abdominal muscles. The pain is attended with great anxiety and mental depression, and is increased on the slightest pressure, by coughing, by taking food, and by deep inspirations. These symptoms are soon followed by constant retching, nausea, and painful vomiting, and the suffer-

The causal indication may require an emetic, *e. g.* where decomposed food keeps up the catarrh. Where injurious ingesta have passed into the bowels, and constipation exists, a purge of rhubarb and senna may be given. If there be excess of acid in the stomach carbonate of soda and bismuth are indicated. If there be evidences of fermentation a drop of vomited matter, mixed with weak solution of iodine, should be placed under the microscope. If torulæ be present they will appear in the form of chains or cells of a brown colour. In such cases anti-fermentative remedies, as calomel, carbolic acid, creasote, sulphurous acid, and nux vomica are useful. Vomiting occasionally persists, owing to failure of vital powers. In such cases brandy with soda-water or champagne may be given to prevent great prostration. During convalescence vegetable bitters should be given, as functional weakness of the stomach continues for a long time after the inflammation is subdued. In gastritis due to poison measures must be adopted to expel the noxious substance from the stomach, and recourse must be had to suitable antidotes.

Chronic Gastritis

Is a most common disease, and met with in everyday practice. It is of a catarrhal nature, and comprises all forms of chronic gastric derangements known as inflammatory dyspepsia.

Causes.—Men are more subject to it than women, and the working classes more than others. It is often traceable to hereditary predisposition, and is especially common in plethoric subjects. The chronic disease may follow acute gastritis, prolonged by neglect; or may be the result of errors in diet, as long-continued use of irritants, of alcohol in excess, and of hot condiments. It occasionally follows the injudicious administration of turpentine and copaiba. Too much meat, too frequent repetition of meals, and imperfect mastication are common causes. It also occurs in cirrhosis of the liver obstructing the portal vein; in affections of the heart, lungs, and pleura, which cause venous obstruction; in chronic disease of the kidneys; in long-continued congestion and in chronic organic affections of the stomach, as cancers and ulcers; in pyloric obstructions and dilatation of the stomach; in poisoned states of the blood, as in gout; in phthisis, and in other wasting disorders.

Anatomical appearances.—The mucous membrane of the stomach is reddish brown or grey, owing to the hæmorrhage (capillary) into the submucous tissue, and the transformation of the hæmatin of blood into pigment. The mucous membrane is hypertrophied, and presents prominences and furrows, which are most marked at the source of the hæmorrhage. When due to erosions these are small, round, or elongated openings on the ridges of the mucous membrane. Where large vessels have been opened the mouths are gaping, and dark clots of blood are found in their neighbourhood.

Symptoms.—If the hæmorrhage be not abundant or if the blood be not vomited it cannot be recognised during life. These cases are not uncommon and may continue for some time, and present only symptoms of extreme weakness and bloodlessness. Hæmatemesis is generally preceded by some premonitory symptoms. When due to acute gastritis it is preceded by pain, tenderness, and heat at the pit of the stomach. The blood, though often vomited, is seldom profuse at one time. In ordinary cases the symptoms of chronic gastritis precede the attack, the patient complains of tension or pressure about the epigastrium, and sometimes of nausea. There is pallor of the face; the skin is cool. There are sometimes sparks before the eyes, noises in the ears, a feeling of giddiness, and a sweetish or saltish taste in the mouth. These symptoms are rapidly followed by vomiting of blood, partly fluid and partly coagulated. When the hæmorrhage is in large quantity the usual symptoms are exhibited. In some cases syncope occurs. The patient soon recovers from faintness and then vomits a large quantity of blood. Collapse sometimes occurs without premonitory symptoms and there may be no vomiting, but the blood passes into the bowels. Where the bleeding often recurs the patient becomes excessively anæmic, and such cases may end in death by syncope. If the blood enters the larynx it gives rise to coughing and even to symptoms of suffocation. If much blood passes downwards into the bowels the stools are dark-coloured and highly fœtid; sometimes they have the appearance of tar. Where fainting occurs it is generally a favorable sign, as further hæmorrhage is checked.

Character of the blood.—The blood may be either fluid or coagulated; it may be ejected alone or mixed with mucus and other contents of the stomach. It may simply well up, or be vomited after great efforts. The appearance also varies with the quantity of blood vomited; with the time it has remained in the stomach; with the condition of the patient; and with the state of the vascular system at the time. When the quantity is large, as when the blood is from a large vessel, it is generally pure and unmixed. In cases of aneurysm it is florid and fluid. In diseased conditions of the stomach, liver, spleen, or pancreas the blood oozes out slowly. If there is time for the gastric juice to act upon it, it is of a dark venous colour.

Terminations.—Very few persons die immediately from the effects of moderate gastric hæmorrhage. There is great exhaustion tives from time to time. The patient should be properly clothed: he should wear flannel next the skin. Change of air and of scene, exercise in the open air short of fatigue, relaxation from heavy bodily or mental work, and sea bathing are generally beneficial. Where the stomach becomes dilated, the organ should be washed out with soda-water by means of a stomach-pump. This procedure has the advantage of restoring the tone to the weak stomach. In every case of gastric catarrh the cause must be sought for and removed if possible. When due to disease of the heart or lungs the congestion of the gastric veins can be relieved only by improving the condition of the original complaint. In such cases digitalis is a useful remedy. Where the disease is secondary to chronic kidney disorder, remedies which promote the elimination of effete matters yield satisfactory results.

CHRONIC ULCER OF THE STOMACH.

Excoriations or superficial ulcers which occur in the ordinary course of gastritis, as a rule, undergo a spontaneous cure. In this part of the work we describe those ulcers which are deep seated. whose origins are often obscure, and which lead to serious symptoms, and even death. The chief clinical phenomena are: localised pain, vomiting, hæmatemesis, emaciation, general debility, and symptoms of indigestion. The ulcer may heal and recovery take place, or may extend and lead to perforation, and to fatal peritonitis, or to fatal hæmorrhage. Death may also occur from inanition.

Causes.—These are predisposing and exciting. Predisposing causes: *Age.*—The complaint is rare in children and before puberty. when the functions of the stomach are very active. As age advances it becomes more frequent. *Sex.*—It is more common in women than in men, in the proportion of three to one. In females it is most prone to occur at the commencement and at the cessation of the catamenia. Poor persons are more liable to it than others. Various depressing conditions, mental anxiety, &c., are predisposing causes. Syphilis and tubercular affections, by diminishing the reparative processes in the body, are causes of gastric ulceration. All those conditions which lead to chronic gastric catarrh, such as diseases of the heart or liver, and long-continued use of irritants and of alcoholic drinks favour the production of gastric ulcer.

Pathology.—The round chronic ulcers are confined to the stomach and duodenum—parts where the acid secretion comes in contact with the tissues. The ulcers are thought by some to be dependent upon the solvent action of the gastric juice. But against this theory there is the fact that ulceration is very rare where the secretion is most active, or where it remains longest, as, for example, at the fundus of the stomach. It is said that the alkaline blood always counteracts the destructive power of the gastric juice, and that the fluids in the tissue of the stomach and duodenum, by thus neutralising the effects of the highly acid secretions, prevent necrosis. When the circulation is obstructed this check is removed, and ulcers result. The ulcers may be due to sloughing, as occurs in persons broken down by syphilis, kidney diseases, &c. Ulcers in such cases occur in the stomach as in the mouth. The sharp border of the ulcer and the absence of signs of inflammation at its periphery show that it is due to partial necrosis and to the formation of a slough, and not to a gradual breaking down, as from inflammatory suppuration. The partial necrosis may be due to obstruction to the blood-vessels supplying and nourishing the gastric tissues. This obstruction may be formed by an embolus. Ulcers met with in young girls have been attributed to extravasations into the submucous tissue of the stomach, causing pressure on the nutrient vessels. Such ulcers are most frequently present near the pylorus, where catarrh commonly occurs. In old people the degenerative changes in the arteries are a possible cause of gastric ulcers, which in these cases seldom cicatrize. The fatty and fibroid degenerations of the coats of the stomach which occur in the aged, lead to considerable alteration in the tissues. Under such circumstances, any slight irritation would readily set up ulceration.

Anatomical appearances.—Simple ulcer of the stomach is found in 5 per cent. of deaths from all causes. The usual positions of an ulcer are the posterior surface, the lesser curvature, and near the pylorus. When two are present they are generally opposed to one another. The ulcers vary in size, from half an inch in diameter to several inches. If looked at from within the stomach the ulcers appear terraced, the loss of tissue being greatest in the mucous membrane. They are met with in various stages of destruction, beginning with the mucous membrane, and extending into the peritoneum. In recent formations their edges are sharp, even, and clean cut, and the ulcerated portion appears as if stamped or punched out of the gastric walls. When an ulcer has existed for some time the edges are hard and callous, and adhere to the adjacent structures. The margins are greyish, pale red, or deep brown, and well defined, of natural thickness and consistence. The ulcer is conical or funnel-shaped, with the apex next to the peritoneum. The base of the ulcer is generally smooth or covered with a slough. Granulations are sometimes seen on the surface. The base of the ulcer may be formed either of the muscular coat or of the serous membrane or of the adjacent organs, as the liver, pancreas, or spleen. In some instances the abrasion is slight, frequently the mucous coat useful to allay pain, to lessen irritability, to prevent lacerations, and also to diminish peristaltic movements. Of these remedies opium is by far the best. It may be given in doses of one grain every morning and evening. When the stomach will retain nothing rectal alimentation may be tried. When the local symptoms have subsided, arrowroot, milk and lime water, or other nourishment, should be given in small quantities and at frequent intervals. Hot liquids, as hot tea or coffee, or any other food which may irritate the stomach, must be forbidden. Vomiting is a most distressing symptom, and arrests the healing of the ulcer. If fungi be present in the vomited matters, creasote, carbolic acid, or sulphurous acid may be given. If the vomited matters contain abundant mucus, bismuth, magnesia, or oxalate of cerium may be given. Vomiting of blood may be arrested by turpentine, with or without small doses of creasote. If perforation takes place as indicated by symptoms of general peritonitis, all that can be done is to give solid opium in full doses. In chronic cases nitrate of silver and bismuth may be tried.

MALIGNANT DISEASES OF THE STOMACH.

Of all the internal organs the stomach is the one most frequently affected by cancer, which is usually primary. Scirrhus is the most common form; next, the medullary; the colloid variety is very rare. Simple ulceration is much more common than cancer.

Causes.—Cancer of the stomach is more common in men than in women; the liability is greatest between the ages of forty and sixty. The disease is often hereditary; neither anxiety nor intemperance influences its production.

Anatomical appearances.—Cancer is chiefly found in the pylorus, next in order at the cardiac orifice, and rarely in other parts. It has a tendency to spread transversely; it seldom extends to the duodenum, but if at the cardiac orifice the œsophagus is generally implicated. Scirrhus begins in the submucous tissue and causes induration and thickening; it then spreads into the deeper coats. The tumour sometimes shows itself in small nodules, sometimes it forms a diffuse hard mass. Changes take place in the mucous membrane. It is at first united with the subjacent growth, but soon softens into a black sloughing pulp, the separation of which leaves the cancer exposed to view. The muscular coat is at first hypertrophied, but is subsequently destroyed by the extension of the growth. The serous coat is thickened and clouded. When ulceration is fully developed the usual appearances of cancer are presented. The medullary variety is much softer than scirrhus, and

spreads more rapidly. Its masses are soft and look like brain substance. It commences beneath the mucous membrane of the stomach, and then rapidly spreads to the other coats. The growth has a tendency to break down into a soft black sloughy mass, which, on separating, leaves an excavated ulcer, surrounded by elevated everted, cauliflower-like edges. Such an ulcer may cover eight square inches. Colloid cancer is rare, but is sometimes associated with scirrhus. The tumour consists of innumerable small cavities or vesicles containing gelatinous fluid. Its free ulcerated surface is ragged, but loss of substance is never very deep.

The cancer often extends to other organs, and especially to the lymphatic glands, the pancreas, the liver, the transverse colon, and to the omentum. Very often it causes adhesion of the stomach with other organs. Occasionally it leads to perforation and fatal peritonitis. The seat of the cancer influences the shape and size of the stomach. Scirrhus cancer is most often seated at the pylorus, and in such cases the stomach is dilated and its walls hypertrophied. When the cancer (medullary) is at the cardiac end the stomach is contracted and small. When the middle portion is affected the stomach assumes the form of an hour-glass.

Symptoms.—The diagnosis of malignant affection of the stomach is sometimes very difficult during life. Symptoms of ill-health and of loss of flesh and strength generally manifest themselves long before the disease becomes established; these symptoms are due to atrophy of the gland structure. The patient is generally cachectic, and has a yellowish anæmic hue of the surface, and the lips are pale. There are sometimes only general symptoms of ill-health; neither pain nor vomiting is present, and no tumour is discoverable. In other cases symptoms of chronic gastric catarrh, such as indigestion, loss of appetite, flatulence, nausea, vomiting, and acid eructations manifest themselves. Occasionally cancer sets in with hæmatemesis. All these symptoms when well marked can hardly be mistaken for those of any other affection. Cancer of the stomach always rapidly increases, and the symptoms progress from bad to worse. The most marked symptoms are pain at the epigastrium or back or in the hypochondrium, tenderness on pressure, and vomiting. The tenderness is not so limited nor so severe as in ulcer. At first it is slight and there is only uneasiness, and a feeling of weight or fulness in the stomach is complained of after food. In some cases there is a gnawing, aching sensation, or a neuralgic and shooting pain with tenderness. The pain is increased during digestion, but, unlike the pain of ulcer, it is severe both when the stomach is empty and soon after taking food. In encephaloid cancer the pain is often slight or almost wanting. Tender-

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ness over the epigastrium is rarely absent. Vomiting is a very common symptom. It generally follows every meal. In advanced cases vomiting after a time ceases, owing to extensive degeneration and atony of the walls of the stomach. Vomiting varies in its character with the seat of the tumour. If the cancer be at the cardiac end the food accumulates in the œsophagus and regurgitation takes place. Deglutition is difficult and is followed by a sense of obstruction in the lower part of the sternum. At first there is difficulty in swallowing solid food; at length only liquids pass, and even they are regurgitated. The food rejected is either without change or only mixed with glairy mucus. If the cancer be seated at the pyloric end the food accumulates in the stomach and there is much acidity and flatulence. Vomiting occurs some time after the ingestion of food, which is rejected either by frequent regurgitations or by copious vomiting from time to time. At an early period of the disease the vomited matters consist of food more or less digested mixed with mucus, and sometimes with sarcinæ. Cancerous elements are rarely found. In advanced cases the vomited matters are often black like coffee-grounds, owing to their being mixed with blood from the ulcerated surface and to capillary hæmorrhage. Copious hæmorrhage is more rare than in simple gastric ulcer. In advanced cases diarrhœa sets in and increases the weakness. The most important of all symptoms is the presence of a tumour in the epigastrium or right hypochondrium, though this symptom is absent in about 20 per cent. of all cases. When present and not very large it may not be detected unless the patient is much emaciated. It may often be mistaken for disease of the liver, spleen, pancreas, or omentum, or for fæcal accumulation in the transverse colon. Cancer at the cardiac orifice does not give rise to a perceptible tumour inasmuch as the growth is deeply seated. The tumour when at the pyloric end can generally be felt; it forms a well-defined irregular nodulated growth. It is hard to the touch and generally sensitive. Its size varies from that of a small egg to that of an orange or even larger; it may be either moveable or immoveable. All the symptoms progress regularly. In some cases ascites occurs; in others, œdema of the feet and general anasarca; in others jaundice from implication of the liver. The disease has a tendency to spread to the neighbouring organs.

Course.—Gastric cancer destroys life more rapidly than any other, the average duration being one year. In some cases the progress is very rapid and the disease may prove fatal in a month, while in others the course is more prolonged, and a remission occurs in the severity of the symptoms. The encephaloid form is

phuric acid, and by enemata. Castor-oil with turpentine and a drop of croton oil are useful purgatives. In this disease diluted sulphuric acid has been recommended in order to convert the lead into the sulphate, and iodide of potassium should also be given as an eliminant. In advanced cases purgatives should be avoided, and the bowels should be kept at rest, or may be acted upon by gruel or warm-water enemata. Alum is supposed to detach lead from the albuminates in the tissues, and to form a soluble compound, which is excreted by the kidneys.

During convalescence from lead colic the bowels should be acted on by enemata of castor-oil and turpentine. A generous diet with exercise in the open air is necessary. Strychnia, with various bitter infusions and pills of aloes and myrrh from time to time, are likely to be useful. Where colic is caused chiefly by change in the structure or position of the bowels emollient injections should be persevered with and the action of the bowels promoted by oleaginous aperients.

Constipation.

This subject has already been discussed (see vol. i, pp. 103—105). Its causes and symptoms have been sufficiently described; it remains now to point out the treatment of the various forms.

In treating cases of constipation the cause should be discovered, and if practicable removed. The constitution and habits of the patient and the complications must be attended to. The treatment should be directed towards procuring fæcal evacuations by gentle and unirritating means. This is done by rendering the muscular coat of the large intestines competent to fulfil its functions, and by restoring the sensibility of the lower part of the bowels. The calls of nature should be attended to every day and at one particular time. The desire should never be disregarded and the performance of the duty never postponed or hurried. Constipation when actually present must be dealt with by attention to the diet and habits, and by exercise, medicines, and mechanical means. Habitual constipation may be much relieved by the adoption of a regular and proper diet. The food should be digestible and wholesome; a large variety of dishes should be avoided. Animal food should be taken once or at most twice daily. Bulky or starchy food such as bread, biscuits, rice, and sago should be taken in great moderation. Green vegetables are useful; brown bread with honey or treacle agrees with many persons, and may be recommended. Strong coffee or tea should not be given. Certain articles increase the peristaltic movements of the intes-

Gastric Ulcer.

1. Seldom before twelve years; liability greater at the commencement and cessation of catamenia.

2. More frequent than cancer.

3. More common in women; in the proportion of three to one in men.

4. Depressed condition by want of food, mental anxiety, &c.

5. Intemperance, syphilis, and tuberculosis are predisposing causes.

6. Wanting.

7. Profuse, blood unchanged.

8. Unaffected.

9. No tumour.

10. Lasts for many years.

11. Severe; increases after food; relieved after vomiting and by recumbent position.

12. Limited and constant.

13. Seldom directly after food; preceded by nausea and profuse flow of saliva.

14. Very slow or absent.

15. Any part; the orifices less frequently affected.

Prognosis.—It is always unfavorable, and death is rapid in proportion to the emaciation. The occurrence of vomiting of coffee-ground matter, and evidence of the disease having implicated the liver or other organs, point to a speedy termination.

Treatment.—This can be only palliative. For the relief of pain opium is the best remedy. Vomiting may be allayed by sucking ice and by drop doses of creasote. To relieve the indigestion attention must be paid to the diet. Stimulants and nutrient enemata may be tried with a view to prolong life; if diarrhœa is produced laudanum should be added to the enemata. The acidity and distension of the stomach may be relieved by alkalies and bismuth. Condurango bark has been recommended with a view to diminish the size of the tumour and to check its further ravages.

PERFORATION OF THE STOMACH.

This is generally the result of simple ulcer or cancer. In rare cases it is due to mechanical injury. Extension of disease from the neighbouring organs is another cause. In whichever way perforation occurs the peritoneal cavity is opened. The ulceration extends till at last it reaches the peritoneum, which sloughs, and the contents of the stomach thus escape into the peritoneal cavity. Such cases

cases hard scybala or fæcal accumulations are found in the descending colon or rectum, owing to deficient secretion of moisture. Under these circumstances an occasional dose of castor-oil or salad oil, or of rhubarb with small doses of ipecacuanha, may be given with benefit. Drinking-water often contains lime, and therefore causes constipation. This should be avoided by using water previously boiled.

In constipation due to pregnancy castor-oil is the most efficient remedy we possess. It should be used occasionally. A little rhubarb and nux vomica combined with a tonic is a good substitute. In women who have borne many children, and in whom the abdomen is pendulous, constipation can be best treated by the use of elastic abdominal bandages and by perfect rest. Constipation due to hæmorrhoids is always attended with hepatic derangements, and may be relieved by improving the condition of the liver. In these cases aloes should be avoided. Belladonna, podophyllin, and senna may be given with advantage. Spasmodic stricture of any part of the bowels gives rise to serious constipation attended with pain. Under the use of opium, either internally or subcutaneously injected, the spasm and pain are relieved, and regular peristaltic action restored. When the spasm is due to local thickening, to impacted calculi, to foreign bodies, or to twisting or intussusception, gentle rubbing of the abdomen with warm oil, or the application of hot poultices sprinkled with laudanum should be tried; copious enemata of warm gruel and castor-oil or olive oil should be administered.

When impaction of fæces occurs it is necessary to remove the scybala from the rectum by means of a scoop or by the hand. An injection of a pint of lukewarm water and soap, or of thin gruel with oil, will then be advisable. For obtaining prompt relief injections are preferable to internal remedies, but if repeated daily they not only lose their effects but diminish the muscular power and sensibility of the rectum. If the accumulation and impaction be high up, the long gum-elastic tube must be used. In infants suppositories of soap and molasses may be tried. In cases of constipation friction to the abdomen sometimes affords relief. Electricity has been used with success in obstinate constipation, one pole, in the form of a bougie, being placed in the rectum, and the other applied to the abdomen.

Exercise.—The exercise should be short of fatigue; walking or riding is the best form. Kneading the muscles of the abdomen every morning or when at stool, and friction in the course of the large intestine by the ends of the fingers may be tried, as they excite peristaltic movements. These movements have been known up, and sometimes a coffee-coloured fluid; the latter especially occurs when the disease is associated with ulcer. The appetite is impaired or lost; there is emaciation; the bowels are confined. In advanced cases there is dropsy of the abdomen and anasarca of the feet. Patients generally die of exhaustion or of peritonitis. The disease may last for years, or death may occur in a few months.

On *palpation* a tumour may be felt in the epigastric region; it is moveable from side to side, smooth on the surface and tender to the touch. It feels as a solid growth.

Diagnosis.—Such cases are often mistaken for cancer of the stomach or other morbid growths or foreign bodies. The smooth feel of the tumour and the absence of implication of the liver or any other organ exclude cancer. In advanced cases absence of history of predisposition for cancer, absence of constant agonizing pain, the long duration of the illness, the vomiting directly after food, are symptoms which tend to confirm the diagnosis of fibroid thickening.

Treatment.—The capacity of the stomach being diminished very little food can be taken. It is therefore necessary to give liquid nourishing food in small quantities and repeatedly. Milk and soups are generally suitable. The pain may be relieved by opium either internally or hypodermically injected. Repeated blisters, anodyne applications, and occasionally leeches to the epigastrium may be advised for the same purpose.

OBSTRUCTION OF THE ORIFICES OF THE STOMACH.

Obstruction of the pylorus is an organic lesion of that orifice of the stomach. It usually accompanies fibroid thickening. In such cases there is abnormal development of fibrous tissue in the submucous tissue of the pylorus. The mucous and muscular coats and their connecting cellular tissue are hypertrophied.

Causes.—These are organic disease of the pylorus and cicatrisation of gastric ulcers near the pylorus. Obstruction may also be due to long-continued chronic gastritis and to the presence of a tumour pressing on the pylorus. Excessive use of raw spirits and excesses in eating and drinking keep up irritation at the pylorus, and lead to thickening of the orifice.

Morbid appearances.—The walls of the pylorus are thickened and converted into fibro-cartilaginous tissue, and there is contraction of the orifice. The stomach is dilated and its muscular walls hypertrophied. The calibre of the small intestine is much narrowed. Obstruction at the cardiac orifice leads to dilatation of the œsoduodenum and sometimes obliteration of the bile duct. The symptoms of ulceration are generally very obscure; jaundice and disturbance of digestion are those which present themselves. The treatment is the same as that of perforating ulcer of the stomach. Perforation due to burns occurs generally after the tenth day.

Scirrhus is the most common morbid growth. It affects the wall and causes narrowing of the canal; it may set up chronic inflammation, or obstruct the bile duct and cause jaundice.

ENTERITIS.

It is an inflammation of the intestines, presenting many grades of severity. The simplest form is known as enteritis catarrhalis. Other forms are the diphtheritic, phlegmonous, and dysenteric enteritis. In these affections, beyond the ordinary characters of inflammation, there are certain specific features due to some peculiar cause or to the predisposition of the tissue.

In enteritis there are structural changes affecting the mucous membrane of the intestines. These changes may be due to local irritants or to those circumstances which give rise to inflammation in other parts. In addition to the mucous membrane, the muscular and even the serous coat may subsequently become involved. As a result the inflammation may lead either to productive changes such as the formation of pus or connective tissue; or to destructive processes as ulceration and gangrene. The inflammation may affect the whole of the intestinal tract, and is then termed *general enteritis*, or may be limited to certain parts. *Local enteritis* includes duodenitis, ileitis, typhlitis, colitis, and proctitis. *Catarrhal enteritis* is the simplest form of inflammation. It may be acute or chronic. The disease often occurs in children and when severe it is known as *cholera infantum*. It is characterised by general symptoms as fever, marked constitutional disturbance, and by disordered functions of the intestines.

Causes.—Enteritis catarrhalis (acute) may be the result of hyperæmia, which induces transudation of a fluid rich in salts, but deficient in albumen. Its causes are predisposing and exciting. The predisposing causes are the exposed situation of the intestines to any irritant swallowed. The structure of its mucous membrane also favours the occurrence of inflammation. It is very common in children during dentition, and the moderate catarrh sometimes passes into serious enteritis. The complaint often occurs during summer, and especially when there are great differences between the day and night temperature, and much moisture is present. The disease is sometimes epidemic.

turpentine. Pain may be relieved by the hypodermic injection of morphia or by hydrate of chloral. For the acidity alkalies, as magnesia, soda or lime-water are very useful. They may be combined with bismuth. Hyposulphite of soda in thirty-grain doses, with vegetable bitters, creasote, and carbolic acid, have all been recommended for the relief of the acidity and other distressing symptoms. Cod-liver oil may be given if the patient can tolerate it.

(2) Contraction of the stomach may be either general or partial. When general the organ is uniformly reduced in size. The affection is rare, and when it occurs is most frequently the result of inanition or long-continued abstinence from food, as in cases of disease of the œsophagus or of the cardiac orifice of the stomach. Excessive and long-continued vomiting is another cause. As a result of cancer or ulceration in the lesser curvature the stomach is generally reduced in size, owing to the approximation of the two orifices. The contraction may be partial, and is then due to puckering of the coats as occurs in cicatrization of an ulcer. Where the contraction is limited to the pyloric region hypertrophy of the muscular coat of the stomach takes place. In all cases of contraction the symptoms are those of cardiac obstruction. There is great difficulty in swallowing food, and vomiting follows the effort. The appetite is good, but the patient cannot take enough to satisfy it. The food may remain in the œsophagus and set up putrefaction or fermentation. Death is due to inanition.

Treatment.—Attempts must be made to relieve the symptoms. Food should be given in a liquid and concentrated form.

NEUROSES OF THE STOMACH.

These include gastralgia, spasm, hyperæsthesia, and nervous vomiting.

Gastralgia signifies pain in the stomach, a symptom which is met with in a variety of morbid conditions.

Causes.—It is due to a morbid condition of the nerves supplying the stomach, or to some affection of the ganglia or the plexuses. It is a common symptom of dyspepsia, anæmia, and chlorosis. Sedentary habits, mental anxiety, and severe losses of blood are predisposing causes. In acute erythematous gastritis a burning painful sensation is felt almost immediately after taking food or stimulants. In so-called eczema of the stomach the pain is severe, and comes on two or three hours after food, though temporarily relieved by eating. In disordered and profuse secretion of the stomach the pain is severe, and also occurs some time after food.

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neuralgias points to spasm. 5. In spasm there is pain even when the stomach is empty; in ulcer the pain is generally after food.

Prognosis.—As a functional disorder the pain alone is not to be viewed as a dangerous symptom. When the pain is accompanied by misplaced gout or is complicated with some affection of the heart, and attended by irregular or intermittent pulse, the prognosis is very grave. In old people and in persons addicted to excesses in alcohol, spasmodic pain in the stomach should be regarded as a dangerous symptom.

Treatment.—The chief indication is to allay the suffering. This can sometimes be effected by removing the cause. When indigestible food is present in the stomach or bowels an emetic in the one case, and a dose of castor-oil with opium in the other will often suffice. When due to fermentation or to undue acidity in the stomach, a combination of alkalies with vegetable bitter infusions and opium is required. For spasms or cramps in the stomach, antispasmodics with opium may be prescribed and repeated every half-hour till the pain is relieved. Brandy, camphor, ether, assafœtida and ammonia will sometimes afford relief. Counter-irritation as by mustard plaster or turpentine stupes is always useful. Warmth may be applied to the extremities by means of hot bricks or bottles of hot water. When vomiting is severe it may be allayed by hydrocyanic acid. The pain dependent on flatulence can be best relieved by rhubarb and magnesia, combined with peppermint or ginger or other carminatives. That caused by misplaced gout needs careful attention. Large mustard plasters should be at once applied to the epigastrium and to the legs, and an aperient of rhubarb and magnesia may be prescribed. When the gastralgia is supposed to be a purely nervous disorder the galvanic current may be tried. If a malarious origin be suspected quinine should be given. Salicin in fifteen grain doses has been given with benefit; small doses of Fowler's solution may also be tried. When the pain frequently recurs, the cause, which often lies in errors in diet or in weakness of the stomach, must be sought for and removed. The regulation of the diet is a point of great importance. All indigestible substances should be avoided.

Hyperæsthesia of the stomach is a condition in which there is increased sensitiveness of the organ when touched. It is a common accompaniment of many gastric disorders. It generally occurs in nervous girls and is worse at the catamenial periods and yields to iron and other tonics as quinine, strychnia, and vegetable bitters. Small doses of arsenic are often very useful and should be given directly after meals. Change of air is often very beneficial.

Vomiting is sometimes a neurotic affection. Such vomiting is

generally habitual and occurs without nausea and without any gastric or other lesion to account for it. The patients are for the most part the subjects of hysteria or of phthisis. In the former affection the vomiting occurs immediately food is taken. The vomited matters are seldom sour. The patient loses flesh and strength, but not in proportion to the extent of the vomiting. Various remedies have been tried, but no one of them can be relied upon. Drop doses of ipecacuanha wine succeed with a few. A pill containing one-sixth of a grain of morphia is perhaps the most useful. Hydrocyanic acid, aconite, bismuth, oxalate of cerium, nitrate of silver and blisters to the epigastrium have been employed with varying results. In some cases a few drops of Liquor Morphiæ with solution of potash given a few minutes before food will subdue the irritability. In very obstinate cases abstinence from all food by the mouth may be tried and nutrient enemata administered for a few days.

MALPOSITIONS OF THE STOMACH.

The stomach may be displaced congenitally, or in consequence of disease or accident. In congenital cases the stomach may occupy the right side of the body, the pylorus pointing to the left. It may occupy the left pleura, the diaphragm being imperfectly developed. In cases of accident it may be situated in the left pleura owing to rupture of the diaphragm, and this displacement may be mistaken for pneumothorax of the left side. In such cases there is a clear sound on percussion, and the respiratory sounds can be heard in the upper part of the left lung. The clear percussion sound becomes duller after food. There is dyspnœa owing to the displacement of the heart. In hernia of the stomach through rupture of the diaphragm there is vomiting of food, and the vomited matter contains sarcinæ. In pyloric tumours the weight of the growth displaces the stomach downwards. The stomach has been known to form a portion of the contents of umbilical and scrotal herniæ. A dilated stomach may be displaced downwards by the weight of its contents. In such cases the epigastrium is depressed and the umbilical region distended and prominent.

HÆMATEMESIS.

Hæmatemesis signifies vomiting of blood and is a symptom of many gastric and hepatic disorders. In hæmatemesis the blood is bright red in colour if vomited at once, and if arterial, as in cases of gastric ulcer and aneurysm. When due to cirrhosis or other obstruction to the portal system it is large in quantity but dark in colour. It is generally mixed with ropy or watery fluid and other

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In the majority of cases hæmatemesis is the consequence of some lesion in the stomach or in the neighbouring viscera, as the spleen, liver, and pancreas. Hæmorrhage may proceed from the mucous surface of the stomach, or from that of the duodenum or œsophagus. There are three pathological conditions, to any of which hæmatemesis may be due. These are (1) rupture of the over-filled blood-vessels without change of structure; (2) rupture of diseased vessels; (3) diseases of the blood, so that transudation takes place through the vessels.

Arterial fluxion is a rare cause of hæmorrhage. It occurs in inflammation of the stomach, and chiefly in the advanced stage. Hæmatemesis setting in shortly after a meal is a common symptom in ulcer of the stomach. The quantity varies from a mere streak to several ounces. The ulcer most commonly opens into the splenic artery, but when adhesions are formed with the pancreas or liver the opening may take place into the blood-vessels of these viscera. Gastric hæmorrhage occurs in rare cases without pain and without vomiting. In aneurysm the hæmorrhage is always profuse. Hæmorrhage into the stomach may be due to cancer, corrosives, and irritant substances, or foreign bodies, and to external violence, as a blow upon the epigastrium.

Hæmatemesis is a common symptom of congestion of the portal system. Marked cases of this kind occur whenever there is plugging of the portal vein or its large branches by emboli or cancerous matter. Hæmorrhage from hyperæmia of the gastric mucous membrane is ordinarily due to cirrhosis, chronic congestion, or other diseases of the liver. Hæmatemesis sometimes occurs in persons suffering from mitral obstruction, and it may be vicarious to menstruation. In cirrhosis of the liver hæmatemesis is accompanied by symptoms referable to the hepatic region, and by those of chronic gastritis. The blood vomited is dark and grumous. The stools are dark, offensive, and loose. There is often accompanying dropsy (ascites) and general anasarca.

Hæmatemesis sometimes occurs in cases where there is a tendency to hæmorrhage generally. The mucous membrane of the stomach is more or less congested, and the vessels are weak and the blood is altered in composition. Such hæmorrhage is common in the hæmorrhagic diathesis, in purpura, and in the advanced stage of malarious and yellow fevers.

On post-mortem examination it is sometimes difficult to find the source of the hæmorrhage. When due to erosions these are small, round, or elongated openings on the ridges of the mucous membrane. Where large vessels have been opened the mouths are gaping, and dark clots of blood are found in their neighbourhood.

Symptoms.—If the hæmorrhage be not abundant or if the blood be not vomited it cannot be recognised during life. These cases are not uncommon and may continue for some time, and present only symptoms of extreme weakness and bloodlessness. Hæmatemesis is generally preceded by some premonitory symptoms. When due to acute gastritis it is preceded by pain, tenderness, and heat at the pit of the stomach. The blood, though often vomited, is seldom profuse at one time. In ordinary cases the symptoms of chronic gastritis precede the attack, the patient complains of tension or pressure about the epigastrium, and sometimes of nausea. There is pallor of the face; the skin is cool. There are sometimes sparks before the eyes, noises in the ears, a feeling of giddiness, and a sweetish or saltish taste in the mouth. These symptoms are rapidly followed by vomiting of blood, partly fluid and partly coagulated. When the hæmorrhage is in large quantity the usual symptoms are exhibited. In some cases syncope occurs. The patient soon recovers from faintness and then vomits a large quantity of blood. Collapse sometimes occurs without premonitory symptoms and there may be no vomiting, but the blood passes into the bowels. Where the bleeding often recurs the patient becomes excessively anæmic, and such cases may end in death by syncope. If the blood enters the larynx it gives rise to coughing and even to symptoms of suffocation. If much blood passes downwards into the bowels the stools are dark-coloured and highly fœtid; sometimes they have the appearance of tar. Where fainting occurs it is generally a favorable sign, as further hæmorrhage is checked.

Character of the blood.—The blood may be either fluid or coagulated; it may be ejected alone or mixed with mucus and other contents of the stomach. It may simply well up, or be vomited after great efforts. The appearance also varies with the quantity of blood vomited; with the time it has remained in the stomach; with the condition of the patient; and with the state of the vascular system at the time. When the quantity is large, as when the blood is from a large vessel, it is generally pure and unmixed. In cases of aneurysm it is florid and fluid. In diseased conditions of the stomach, liver, spleen, or pancreas the blood oozes out slowly. If there is time for the gastric juice to act upon it, it is of a dark venous colour.

Terminations.—Very few persons die immediately from the effects of moderate gastric hæmorrhage. There is great exhaustion with gradual convalescence. Recurrences are common with intervals of relief. In confirmed drunkards hæmatemesis often occurs at short and regular intervals, and the quantity is large. Such patients generally become dropsical.

Diagnosis.—In hæmatemesis the blood may be primarily effused from the stomach, or it may have flowed into the stomach from the posterior nares, fauces, pharynx, or from the lungs. In hæmorrhage from the posterior nares, fauces, or pharynx, the blood is intimately mixed with the alvine secretions and the stools are black and pitchlike owing to partial digestion of the effused blood by the intestines. In hæmatemesis due to primary effusion into the stomach, premonitory symptoms are generally observed. The blood is usually brown or black in colour, grumous or tarry and mixed with portions of food or bile or with ropy mucus. The dark colour may be due to blood or bile. The latter may be detected by chemical tests. When the blood has really come from the lungs, there is more or less cough with history of heart- or lung-disease. The blood is mixed with bubbles of air and mucus, and is alkaline, and for some time after vomiting the expectoration also contains blood.

Prognosis.—This varies with the nature of the lesion. If with profuse vomiting of blood there is severe pain, tenderness, and a great sense of anxiety the danger is great. The prognosis is grave if there be a previous history of organic disease of the liver, stomach, or spleen, and the patient is cachectic looking. If hæmatemesis has proceeded from the introduction into the stomach of irritant poisons, or from severe injury, as a blow to the stomach, the chances are also unfavorable. When the hæmorrhage is only slight, and is due to congestion of the portal system, its effect is for the most part beneficial.

Treatment.—The first thing to be done is to discover the cause; but it may happen that the symptom requires treatment before the cause can be ascertained. In all cases the patient must be kept perfectly quiet, and in a recumbent position. Small pieces of ice or teaspoonfuls of cold water may be given from time to time, and cold compresses should be applied to the epigastrium. When the hæmorrhage is only slight these means will generally suffice. In more severe cases styptic remedies must be employed, and the best of these are dilute sulphuric acid, alum, acetate of lead, gallic acid, and turpentine. When the symptom is obviously the result of portal congestion two grains of calomel should be given at once, and followed by drachm doses of sulphate of magnesia every three hours, until the bowels are freely acted upon. In the case of hæmorrhage due to ulceration ice, externally and internally, and uninterrupted rest are the best remedies. Styptics are not advisable, for if the stomach contains much coagulated blood these remedies will have little effect upon the seat of the hæmorrhage; and, besides this, they generally increase the nausea and vomiting. After the hæmorrhage has subsided the greatest precautions are necessary with regard to the food. For the first few days the diet must be limited to cold milk and beef tea, given in small quantities and frequently repeated. Alum whey is a suitable beverage, given in tablespoonfuls from time to time. If the bleeding persists nutrient enemata will become necessary. Opium is often serviceable. Purgatives are for the most part mischievous, and when required should be given with great caution, and not until some days have elapsed since the cessation of the hæmorrhage.

DISEASES OF THE INTESTINES.

The food undergoes various chemical and mechanical changes in the stomach, and some of its constituents are absorbed; the remainder passes onwards and enters the intestine. In the small intestine a great part of the aliment is absorbed by the lacteals and blood-vessels; the remainder passes onward into the large intestine, where it acquires a solid consistence, and is then expelled through the anus as fæces.

The period of time required for the transit of any matter through the intestinal canal varies from two hours to twenty-six. In diarrhœa the transit may occupy only two hours; in cases of obstruction it may be weeks. The collection of fæces in the lower part of the large intestines produces an impression and a desire for their expulsion. Habit has made the desire to occur once in twenty-four hours. Where the habit is not responded to, and an accumulation is allowed to ensue, the rectum loses its muscular tone, and the power for expulsion becomes less. This in many persons leads to a host of miseries, as dejection of spirits, derangements of stomach and liver, constipation, and hæmorrhoids.

The fæcal matter consists of articles which are not dissolved by the secretions; a certain proportion of the food, even of a digestible nature, is not absorbed, and mixes with various products derived from the alimentary canal itself, such as epithelium, mucus, colouring matter of bile; but so long as there is normal muscular contraction of the intestine and its secretions are healthy, nothing unusual should occur.

Diarrhœa and cramps or colic are caused by irregular or unnatural contractions of the muscular fibres of the intestine. If the cramps are not soon overcome acute inflammation of the whole bowels or of the small intestine may result. These irregular contractions may also lead to intussusception.

As with irregular muscular contractions so with accumulation of gases. If the collection of gases be inordinate it gives rise to uneasy sensations, known as flatulence or tympanites. Borborygmus is a rumbling noise produced by the movement of the flatus in the intestine. In some cases the fibres of the colon contract round the flatus, and give rise to swellings known as phantom tumours. Where the distension is general a swollen, resonant, and drumlike state of the abdomen is produced, known as tympanites.

When the intestines are very weak they are unable to expel the gas, and it becomes a source of great misery and discomfort.

Diarrhœa, cramps, and flatulence are also the result of fermentation. Where digestion is not properly effected in the stomach fermentation takes place in the undigested food after it has passed the pylorus. During health the mucus secreted by the gland follicles of the intestines assists further digestion; where this is not effected fermentation is the consequence. Like the gastric juice, the bile is an agent which controls and prevents putrefaction. The food, after it has passed the stomach and entered the duodenum or the jejunum, is highly acid, owing to the predominance in it of the acids of the stomach. The acid greatly diminishes, and even disappears, as it reaches the cæcum. In the large intestine the contents are generally alkaline. If the food in the intestine undergoes putrefaction gas is evolved, and flatulence, uneasy sensations in the bowels, as colic, and even spasmodic pain from the irritation or obstruction of the bowels result. Further irritation of the bowels leads to increased mucous secretion and to diarrhœa and vomiting.

INTESTINAL FLATULENCE—TYMPANITES.

Intestinal flatulence, its causes and symptoms, have been already described (see vol. i, page 94) in the chapter on the general symptoms of diseases of the alimentary canal. It remains to indicate the *treatment* to be pursued.

In intestinal flatulence when the gas is imprisoned, enemata containing assafœtida or turpentine are very useful. A long tube should be used. Rhubarb with extract of nux vomica may be given internally. Locally, friction to the abdomen with stimulating liniments and the application of mustard poultices will help to dislodge the flatus. Gentle kneading of the most distended parts also gives relief. Various stimulants as ammonia, ether, and spirit of chloroform, and aromatic carminatives, as cloves, ginger, camphor, and cajeput may be given with advantage. In extreme cases puncturing the colon may be tried. All food likely to ferment should be avoided, and after the acute symptoms have subsided various remedies should be given to check fermentation. The sulpho-carbolates, creasote, and charcoal are often useful. Alkalies with nux vomica are suitable for many cases. Constipation must be prevented by suitable aperients. A combination of aloes, quinine, and belladonna is often very serviceable.

INTESTINAL COLIC AND ENTERALGIA.

Both these affections are the result of irregular, unnatural, or spasmodic contractions of the muscular fibres of the intestines. Enteralgia is a neuralgic affection of the sensori-motor nerves of the mesenteric plexus. The term includes all kinds of pain in the belly, especially about the umbilicus, without any constitutional febrile disturbance. It includes colic proper, which is a visceral neuralgia, and can well be exemplified by the symptoms often due to lead. The term enteralgia is generally applied to paroxysmal pain in the intestine as occurring in neurotic, anæmic, and gouty subjects, and to symptoms in which pain is present rather than spasm. The clinical phenomena are the same as those of colic.

Colic is characterised by severe paroxysmal and twisting pain in the belly, especially about the umbilicus. The pain is relieved by pressure; it is often accompanied by constipation, occasionally by diarrhœa and vomiting. The abdomen is either distended or retracted. There is no febrile disturbance.

Causes.—These are, morbid states of the bowels, and include some of those conditions which give rise to changes in the structure or in the position of the intestine. Thus it is common in obstruction from intussusception, twisting, and strangulation; in ulceration from any cause; in inflammation, as enteritis and typhlitis. Colic from other causes is most apt to occur in nervous, hysterical, and hypochondriacal patients. Young persons and adults are more liable than others, and females are most often attacked. The most common causes of colic are irritating substances contained in the intestines, such as indigestible food, perverted secretions, and the like. Other sources of irritation are the presence of worms, gall-stones, and of fæcal accumulation. Exposure to cold and the use of cold drinks are liable to cause this symptom in some persons. Lead colic has been already referred to (see vol. i, p. 209). Another cause of colic is reflex irritation as due to diseases of the uterus or ovaries, to biliary or renal calculus, to dentition, anxiety, or other mental emotions.

Symptoms.—The condition may be acute or chronic. In either form the characteristic symptom is pain, which is more or less severe and paroxysmal. Besides pain there is distension of the abdomen and constipation. The expression is one of great suffering; the skin is cold and covered with perspiration. The pulse is normal and feeble; there is no fever. The symptoms vary with the cause. In nervous colic the pain is sudden, abrupt, and shifting, and occurs at irregular intervals. In some cases the pain is confined to the umbilicus, where it generally begins. Its duration

spreads more rapidly. Its masses are soft and look like brain substance. It commences beneath the mucous membrane of the stomach, and then rapidly spreads to the other coats. The growth has a tendency to break down into a soft black sloughy mass, which, on separating, leaves an excavated ulcer, surrounded by elevated everted, cauliflower-like edges. Such an ulcer may cover eight square inches. Colloid cancer is rare, but is sometimes associated with scirrhus. The tumour consists of innumerable small cavities or vesicles containing gelatinous fluid. Its free ulcerated surface is ragged, but loss of substance is never very deep.

The cancer often extends to other organs, and especially to the lymphatic glands, the pancreas, the liver, the transverse colon, and to the omentum. Very often it causes adhesion of the stomach with other organs. Occasionally it leads to perforation and fatal peritonitis. The seat of the cancer influences the shape and size of the stomach. Scirrhus cancer is most often seated at the pylorus, and in such cases the stomach is dilated and its walls hypertrophied. When the cancer (medullary) is at the cardiac end the stomach is contracted and small. When the middle portion is affected the stomach assumes the form of an hour-glass.

Symptoms.—The diagnosis of malignant affection of the stomach is sometimes very difficult during life. Symptoms of ill-health and of loss of flesh and strength generally manifest themselves long before the disease becomes established; these symptoms are due to atrophy of the gland structure. The patient is generally cachectic, and has a yellowish anæmic hue of the surface, and the lips are pale. There are sometimes only general symptoms of ill-health; neither pain nor vomiting is present, and no tumour is discoverable. In other cases symptoms of chronic gastric catarrh, such as indigestion, loss of appetite, flatulence, nausea, vomiting, and acid eructations manifest themselves. Occasionally cancer sets in with hæmatemesis. All these symptoms when well marked can hardly be mistaken for those of any other affection. Cancer of the stomach always rapidly increases, and the symptoms progress from bad to worse. The most marked symptoms are pain at the epigastrium or back or in the hypochondrium, tenderness on pressure, and vomiting. The tenderness is not so limited nor so severe as in ulcer. At first it is slight and there is only uneasiness, and a feeling of weight or fulness in the stomach is complained of after food. In some cases there is a gnawing, aching sensation, or a neuralgic and shooting pain with tenderness. The pain is increased during digestion, but, unlike the pain of ulcer, it is severe both when the stomach is empty and soon after taking food. In encephaloid cancer the pain is often slight or almost wanting. Tender-

when it subsides the patient complains of soreness of the abdomen, although there is immense relief from the pain. It sometimes ends in enteritis, and in children in intussusception.

Diagnosis of colic generally.—The absence of fever, the relief obtained by pressure, and the shifting character of the pain exclude enteritis or other inflammatory affections. From gastralgia colic is distinguished by the pain occupying a lower position in the abdomen. In gastralgia the percussion note is deep toned and more prolonged. In colic borborygmi can be traced by the hand, and may even be seen, and there is often tenesmus. If enteritis or peritonitis follow colic the pulse becomes frequent, and there is tenderness on pressure. Lead colic is diagnosed by the history of exposure to lead poisoning, and by the other symptoms.

Treatment.—In all cases of colic the cause should, if possible, be ascertained, and the patient should be carefully examined, in order to see whether any tumour or hernia is present. In colic due to errors in diet these must be attended to. If due to excessive use of acids, alkalies combined with anodynes and carminatives are indicated. Where due to the presence of indigestible food a purgative dose of calomel will relieve the symptoms. Rhubarb and magnesia, with carminatives, may be used for milder cases. In infants when the attack is brought on by improper feeding, a little grey powder with magnesia and carminatives will afford relief. If the meconium is retained a few drops of castor-oil, given by the mouth, will suffice. If in children, owing to want of due attention, accumulation of fæcal matter take place, mild laxatives may be given from time to time. In adults, for colic arising from the same cause, an enema of turpentine with castor-oil and assafœtida is often an efficacious remedy. In acute cases the paroxysm may be checked by small doses of calomel, belladonna, and opium. The hypodermic injection of 5 minims of morphia solution (1 grain in 20 minims), and 1 drop of solution of atropine (1 grain in 100 minims) is the best remedy to procure relief from pain. In hysterical cases Tinct. Valerian. Co., with assafœtida may be given with the above. Should the abdomen be tumid hot fomentations, linseed poultices, turpentine stupes, warm baths, or friction with stimulating liniments, may be tried. In cases of copper colic purgatives guarded by opium are indicated. Hot sulphur baths and antispasmodics give relief to the pain. Plenty of milk and light nutritious diet are very useful in these cases. For lead colic the source of the poisoning must be found out, and further exposure prevented. The pain and discomfort may be relieved by opium, belladonna, and antispasmodics, as ether, and by fomentations. The bowels should be freely moved by Epsom salts mixed with infusion of roses, or with an excess of sul-

phuric acid, and by enemata. Castor-oil with turpentine and a drop of croton oil are useful purgatives. In this disease diluted sulphuric acid has been recommended in order to convert the lead into the sulphate, and iodide of potassium should also be given as an eliminant. In advanced cases purgatives should be avoided, and the bowels should be kept at rest, or may be acted upon by gruel or warm-water enemata. Alum is supposed to detach lead from the albuminates in the tissues, and to form a soluble compound, which is excreted by the kidneys.

During convalescence from lead colic the bowels should be acted on by enemata of castor-oil and turpentine. A generous diet with exercise in the open air is necessary. Strychnia, with various bitter infusions and pills of aloes and myrrh from time to time, are likely to be useful. Where colic is caused chiefly by change in the structure or position of the bowels emollient injections should be persevered with and the action of the bowels promoted by oleaginous aperients.

CONSTIPATION.

This subject has already been discussed (see vol. i, pp. 103—105). Its causes and symptoms have been sufficiently described; it remains now to point out the treatment of the various forms.

In treating cases of constipation the cause should be discovered, and if practicable removed. The constitution and habits of the patient and the complications must be attended to. The treatment should be directed towards procuring fæcal evacuations by gentle and unirritating means. This is done by rendering the muscular coat of the large intestines competent to fulfil its functions, and by restoring the sensibility of the lower part of the bowels. The calls of nature should be attended to every day and at one particular time. The desire should never be disregarded and the performance of the duty never postponed or hurried. Constipation when actually present must be dealt with by attention to the diet and habits, and by exercise, medicines, and mechanical means. Habitual constipation may be much relieved by the adoption of a regular and proper diet. The food should be digestible and wholesome; a large variety of dishes should be avoided. Animal food should be taken once or at most twice daily. Bulky or starchy food such as bread, biscuits, rice, and sago should be taken in great moderation. Green vegetables are useful; brown bread with honey or treacle agrees with many persons, and may be recommended. Strong coffee or tea should not be given. Certain articles increase the peristaltic movements of the intes-

tines and are therefore useful. Fresh fruits as plantains, grapes, oranges, pomegranates, figs (green or preserved), tamarinds, and prunes, taken early in the morning on an empty stomach, are wholesome and in many cases keep the bowels open. The daily use among the Indians of almonds and grapes at dessert is effective in checking constipation. Oils and fats are also useful.

Medicines.—The objects to be gained by medicine are three: 1. To relieve distension of the large intestines by removing mechanical obstruction. 2. To give tone to the muscular fibres of the intestines. 3. To increase the flow of mucus and other secretions. The simplest remedy is a glassful of cold water in the early morning. Where water alone does not succeed, a teaspoonful of table salt or Epsom salts or Rochelle salts may be added. Various mineral waters, as the Friedrichshall or Hunyadi Janos, taken every morning, are well adapted for many cases. A cold douche to the abdomen while sitting in a hip-bath is sometimes useful in giving tone to the bowels. Cold water compresses to the abdomen for some time every morning, and flannel worn next the skin of the abdomen are useful, especially if the belly be pendulous. In habitual constipation small enemata of cold water give relief. In cases where fæces remain lodged in the rectal pouch, relief may be obtained by emollient enemata and by suppositories of soap, or of butter of cocoa. In cases due to atony of the intestinal walls laxatives and purgatives as aloes, colocynth, podophyllin, rhubarb, and gamboge are often employed. These are generally combined with hyoscyamus or belladonna. Nux vomica may be added with advantage. Confection of senna or of tamarind pulp may be given as laxatives. When the object is to excite the glandular secretion and also increase the peristaltic action of the muscular fibres of the large intestine, strong doses of these medicines should not be given, as they produce a violent purgative action at first, but are soon followed by torpor, or exhaustion of the bowels. The aperients should after a time be replaced by tonics, as iron and nux vomica combined with belladonna or atropia. Belladonna is in high repute in such cases. Where the small intestines are chiefly affected, senna and rhubarb with alkalies are the best remedies. If the biliary secretions are at fault blue pill or calomel or podophyllin may be given in small doses. Gentle aperients as senna or sulphur combined with a little belladonna, or pills of aloes combined with sulphate of iron often succeed where other remedies have failed. Pulvis Glycyrrhizæ Comp. is a good combination.

For persons of weak constitution rhubarb and taraxacum with quinine may be prescribed. Castor-oil is very valuable as an adjunct to tonic treatment, and may be given every few days. In some cases hard scybala or fæcal accumulations are found in the descending colon or rectum, owing to deficient secretion of moisture. Under these circumstances an occasional dose of castor-oil or salad oil, or of rhubarb with small doses of ipecacuanha, may be given with benefit. Drinking-water often contains lime, and therefore causes constipation. This should be avoided by using water previously boiled.

In constipation due to pregnancy castor-oil is the most efficient remedy we possess. It should be used occasionally. A little rhubarb and nux vomica combined with a tonic is a good substitute. In women who have borne many children, and in whom the abdomen is pendulous, constipation can be best treated by the use of elastic abdominal bandages and by perfect rest. Constipation due to hæmorrhoids is always attended with hepatic derangements, and may be relieved by improving the condition of the liver. In these cases aloes should be avoided. Belladonna, podophyllin, and senna may be given with advantage. Spasmodic stricture of any part of the bowels gives rise to serious constipation attended with pain. Under the use of opium, either internally or subcutaneously injected, the spasm and pain are relieved, and regular peristaltic action restored. When the spasm is due to local thickening, to impacted calculi, to foreign bodies, or to twisting or intussusception, gentle rubbing of the abdomen with warm oil, or the application of hot poultices sprinkled with laudanum should be tried; copious enemata of warm gruel and castor-oil or olive oil should be administered.

When impaction of fæces occurs it is necessary to remove the scybala from the rectum by means of a scoop or by the hand. An injection of a pint of lukewarm water and soap, or of thin gruel with oil, will then be advisable. For obtaining prompt relief injections are preferable to internal remedies, but if repeated daily they not only lose their effects but diminish the muscular power and sensibility of the rectum. If the accumulation and impaction be high up, the long gum-elastic tube must be used. In infants suppositories of soap and molasses may be tried. In cases of constipation friction to the abdomen sometimes affords relief. Electricity has been used with success in obstinate constipation, one pole, in the form of a bougie, being placed in the rectum, and the other applied to the abdomen.

Exercise.—The exercise should be short of fatigue; walking or riding is the best form. Kneading the muscles of the abdomen every morning or when at stool, and friction in the course of the large intestine by the ends of the fingers may be tried, as they excite peristaltic movements. These movements have been known among the natives of India from remote ages, and they practise them with care and dexterity. In persons of indolent habits outdoor exercise, taken two hours after a meal, together with a plain and unstimulating diet, is beneficial. Sedentary habits and mental fatigue should be avoided. Various indoor exercises, as the use of dumb-bells, are also useful. Cold or tepid baths should not be neglected.

DISEASES OF THE DUODENUM.

The disorders of the duodenum are either functional or organic. *Functional disorder* gives rise to a train of symptoms known as duodenal dyspepsia. These consist of pain in the duodenal region some two or three hours after food, nausea, vomiting, and various other indications of gastric indigestion. There is sometimes extreme drowsiness, burning in the soles of the feet and palms of the hands, and slight jaundice.

Treatment.—As the disorder is generally due to indigestible products which irritate the duodenum, special attention must be paid to the diet. Alkalies with bismuth and calumba, or hydrochloric acid may be prescribed according to circumstances.

Organic disorders.—These are inflammation (duodenitis), perforating duodenal ulcers, and new growths.

Duodenitis.—This is usually of a mild catarrhal character, and connected with gastritis, enteritis, or some affection of the liver. The symptoms are those of gastric catarrh, with jaundice superadded. The disease subsides under proper treatment, but traces of jaundice often remain for lengthened periods. In chronic inflammation, the mucous and submucous tissues become thickened, and adhesions are often formed with neighbouring organs. There are sometimes chronic ulcers on the horizontal part. The inflammation is generally associated with cancer of the liver, pancreas, or duodenum. Contraction of the duodenum also occurs and produces symptoms similar to those of stricture of the pylorus. The treatment of acute duodenitis consists in rest in bed, the use of milk diet, counter-irritation by means of mustard plasters, and the administration of mild purgatives.

Duodenal ulcers.—Ulcers are rare in children. They occur more frequently in men than in women, and are most often seen after extensive burns and scalds. Recent ulcers have clean-cut edges of natural thickness. The occurrence of perforation of the duodenum is followed by peritonitis, or by adhesions with the liver, pancreas, colon, or even gall-bladder. The ulcer may open into the hepatic artery. When the ulcers cicatrize they cause constriction of the phagus and hypertrophy of its walls, and contraction and atrophy of the stomach.

Symptoms.—In a well-marked case of obstruction affecting either the pyloric or the cardiac orifice, starvation, emaciation, and asthenia supervene. If the pyloric obstruction is not complete the food is long detained in the stomach and undergoes various chemical changes, and there is a sense of fulness with distension, and other symptoms of indigestion. Vomiting occurs at irregular intervals, usually several hours after food. A greater degree of or complete obstruction leads to accumulation of food, to considerable gastric uneasiness, to severe pain at the pit of the stomach, and to obstinate vomiting. A great quantity is discharged at one time, and the vomited matters are fœtid, abnormally acid, and have the smell of yeast. Under the microscope they contain sarcinæ or the yeast fungus, or both. In obstruction due to cancer or gastric ulcer the vomited matters sometimes contain blood and coffee-coloured fluid. In all cases of obstruction the appetite suffers, but the patient can take food. The abdomen is more or less distended, and the diaphragm is pushed upwards. Sooner or later dilatation of the stomach with hypertrophy of its walls and contraction of the intestines ensue. If life be prolonged complications are apt to arise. In such cases ulcers ending in gastritis or peritonitis occur.

In cases of obstruction at the cardiac orifice swallowing is difficult, and the food is rejected by eructations. The appetite is good, but the patient suffers from starvation. If not immediately rejected the food remains in the œsophagus, and there it undergoes putrefaction or fermentation. In cardiac obstruction the stomach is contracted, and there is sinking at the epigastrium instead of distension, as occurs in pyloric obstruction.

Treatment.—The most important point in the treatment is the diet. The food should be given in a liquid and concentrated form, and in small quantities at a time. Pepsine and hydrochloric acid are useful to promote digestion. Putrefaction of the food may be checked by creasote and hyposulphite of soda. Another indication is to improve the tone of the stomach, and for this purpose strychnia is useful. If obstruction be due to cancer the treatment will be only palliative. When due to the pressure of an external tumour the cause should be sought for and dealt with as far as possible. In cases of spasm leading to obstruction inhalation of chloroform acts satisfactorily. In obstruction of the pyloric orifice, if vomiting does not occur, this should be promoted from time to time by means of an emetic. In some cases washing out the stomach by means of the stomach-pump does good. In cardiac obstruction dilatation may sometimes be effected by the careful passage of a

Exciting causes.—These at first lead to hyperæmia and subsequently to inflammation. The most common are local irritants, such as improper food and various drugs and poisons. Exposure to cold, wounds, impacted fæces, and gall-stones are other causes of this disease. It sometimes arises as a result of burns, of inflammation of neighbouring parts, and during the course of acute infectious diseases.

Post-mortem appearances.—The catarrh very seldom affects the entire intestine. It is most frequent in the colon, cæcum, and rectum. It is less common in the duodenum and ileum, and comparatively rare in the jejunum. The mucous membrane is hyperæmic, the redness varying from pink to a dark red. The increased vascularity sometimes leads to capillary rupture and formation of petechiæ on the mucous surface. The tissue changes are well marked. There is swelling of the epithelial cells, which are also proliferated. The connective tissue is also increased and full of leucocytes, which form the pus-corpuscles. In inflammation of a specific form, as in diphtheria, the newly-formed cells are contained in a fibrinous coagulable exudation, and form membranous patches adherent to the surface of the intestines. In all cases there is œdema of the intestinal walls from infiltration of serum. The free surface of the mucous membrane is covered with serous fluid containing young cells, and subsequently with glairy mucus containing pus-cells and triple phosphates. The epithelium of the follicles of Lieberkühn is granular and proliferated. The solitary glands and Peyer's patches are swollen, and occasionally the mesenteric glands are hyperæmic and enlarged.

Terminations.—Enteritis may end in resolution. It may become chronic or pass on to ulceration, sloughing, or gangrene.

Forms.—1. *Catarrhal* or muco-enteritis is the name given to that form where the mucous membrane alone is affected. 2. *Phlegmonous* enteritis is a condition in which inflammation affects all the coats, and is attended with suppuration. 3. *Diphtheritic* enteritis is due to a specific cause, and the inflammation leads to a membranous exudation. 4. *Dysenteric* is a term applied to that form of enteritis due to the specific poison of dysentery.

Symptoms.—These vary in different cases, according to the morbid changes in the tissue involved. When different portions are affected the symptoms are often dissimilar, even though the pathological changes may be alike in both cases. The disease may be mild in one person and in another it may prove fatal.

Acute catarrh often begins with restlessness or uneasiness, loss of appetite, great thirst, diarrhœa, pain about the umbilicus, sometimes vomiting, and febrile phenomena. Diarrhœa is the most common and sometimes the only symptom. Besides serous transudation there is acceleration of the movements of the intestines, so that the stools are both more fluid and more frequent. When the catarrh is limited to the upper portion of the bowels there is a tendency for the exudation to become absorbed, and there may be constipation. When the catarrh affects the lower bowels diarrhœa is a marked symptom. In enteritis associated with or occurring as a complication in intestinal obstruction constipation is a marked symptom, and is due to paralysis of the inflamed portion. The evacuations vary in frequency and abundance as the signs of inflam mation become more marked. Their consistence is influenced by the amount of absorption that takes place. At first they are thin and fæcal; in the course of time, if the diarrhœa continues, the discharges are watery, and contain but little solid matter, which consists chiefly of epithelium and other cells. They are rich in saline matters, especially the phosphates of ammonia and magnesia, but contain only traces of albumen. Mucus is present when the rectum is affected. Blood is also seen under similar circumstances, and when hæmorrhoids exist. If food be taken during the continuance of diarrhœa it may be discharged almost without change.

Besides diarrhœa there is nausea, and vomiting if the stomach is involved. In phlegmonous enteritis vomiting is persistent and often stercoraceous. In mild forms there is little or no pain, but in enteritis affecting the colon the pain is severe and persistent, and not relieved by pressure. If the catarrh be confined to the rectum there is constant distress, and the motions are passed with straining and tenesmus. In a majority of cases the pain is referred to the umbilical region. It may be diffused or localised; it is always severe if the peritoneum is involved.

The general symptoms are those of fever with a temperature often as high as 102° or 104°, but in some cases the temperature is normal. The appetite is either unaffected or more or less impaired. The thirst is very great. The tongue is generally furred and dry, and often red at the tip and edges. It may be irritable and glazed. In mild cases it may be natural. The skin is dry, the urine concentrated. Typhoid symptoms sometimes supervene, and in these cases prostration is extreme. Irritability of temper is common, but headache is extremely rare.

In children enteritis rapidly produces symptoms of collapse, and in fatal cases convulsions supervene.

Diagnosis.—In enteritis there is often a history of improper feeding, especially in the case of children. The special symptoms of enteritis are diarrhœa, nausea or vomiting, pain and tenderness in the abdomen, a hard quick pulse, and raised temperature. Absence of headache, of the characteristic rash, and of gurgling in the right iliac fossa, excludes typhoid fever, for which enteritis may be mistaken.

Prognosis.—This varies with the seat and extent of inflammation and with the severity of the disease. In persons in ill-health the disease generally passes on to a chronic form. In children the prognosis should always be a guarded one. In a majority of cases recovery follows, in others, and especially the strumous or the tubercular, without any assignable cause, collapse sets in, ending in death. In adults in favorable cases the disease terminates in a few days; in unfavorable cases extreme prostration, perforation, or chronic ulceration of the bowels is likely to supervene. Chronic enteritis and a tedious convalescence are other terminations.

Treatment.—In enteritis, as in inflammation of any other organ, rest to the part is highly desirable, but cannot be obtained as some food must be taken. Attention to the diet is all-important. The appetite is bad and absorption is interfered with, hence those articles of food which in ordinary health are digestible and nutritious are often unsuitable in enteritis. Abstinence from food, except in the shape of milk, should be practised for a day or two, and afterwards those materials should be selected which are most readily absorbed and leave very little residue. The stomach is generally affected, and hence meat and other proteid compounds instead of being digested may even undergo putrefaction and further irritate the already inflamed bowel. If, however, the tongue be clean, extract of chicken or essence of meat may be given. If there be nausea or vomiting ice may be sucked, or champagne, iced lemonade, or limejuice may be tried. Milk is suitable unless it increases the diarrhœa. In extreme cases iced milk and soda-water is sometimes well borne, and to this brandy may be added. Fat in all forms must be avoided, as it undergoes decomposition and increases the irritation. Starchy foods are also undesirable for the same reason. Where the patient cannot take any food nutrient enemata may be serviceable.

As enteritis is generally attended with fever, and the waste of tissue is enormously great, the patient should be kept in bed, and should wear a flannel bandage over the abdomen. The prominent symptoms require careful treatment. In the early stage the diarrhœa should not be checked; on the contrary, an aperient is useful to remove any irritant that may remain. Calomel is a very suitable purgative in such cases. It may be given in three- or four-grain doses, and be followed after a few hours by castor-oil, if necessary. If the diarrhœa persists even after the irritant is got rid of resort must be had to astringents such as chalk, rhatany, and bismuth, and to these small doses of opium should be added. Nausea and vomiting may be relieved by bismuth, with bicarbonate of potash and citric acid. Leeches applied to the anus may be useful to relieve hyperæmia of the intestinal tract. If the health be bad, and if the diarrhœa persists, ulceration of the bowel is likely to follow. For such cases nitrate of silver, oxide of silver, or even sulphate of copper are useful. When the rectum is especially affected injections of half a drachm of nitrate of silver in two pints of lukewarm water are generally beneficial. A powder composed of ten grains of carbonate of bismuth with five grains of Dover's powder given every four or six hours will relieve the symptoms. Various vegetable astringents are often used for the same purpose. If pain be a prominent symptom the dose of opium must be increased. During convalescence, vegetable bitters, as quassia or calumba may be given with bismuth. By way of prophylaxis such articles of food as may cause the recurrence of enteritis should be forbidden. The patient should wear flannel and avoid exposure to cold and damp. In the weak and debilitated as well as in scrofulous children there is a tendency to collapse, and stimulants should be given from time to time. In children suffering from severe enteritis, life can be preserved only by the judicious use of stimulants. Certain mercurial preparations are also very valuable in these cases. Four or five minims of the solution of the perchloride given every two hours will often cause a great change in the intestinal symptoms and in the character of the discharges. Warmth is also salutary, and warm baths may be given from time to time, their effects being closely watched.

CHRONIC ENTERITIS.

Chronic inflammation of the bowels occurs when the acute disease progresses for some time, or the original cause persists, or when the pathological changes resulting from the acute inflammation become permanent. Other causes are: obstruction of circulation in the liver, and disease of the right side of the heart causing obstruction of circulation in the veins. Chronic enteritis may be secondary to general morbid states as in Bright's disease. In such cases the circulation of a deteriorated blood leads to chronic inflammation. Chronic enteritis is often due to exposure to heat and moisture.

Post-mortem appearances.—The intestine is generally thickened and contracted; the mucous membrane is brown or grey or almost black. It may, particularly in the rectum, present polypoid growths. The epithelial cells are cloudy. The mucous and submucous layers are infiltrated with round cells and connective-tissue

neuralgias points to spasm. 5. In spasm there is pain even when the stomach is empty; in ulcer the pain is generally after food.

Prognosis.—As a functional disorder the pain alone is not to be viewed as a dangerous symptom. When the pain is accompanied by misplaced gout or is complicated with some affection of the heart, and attended by irregular or intermittent pulse, the prognosis is very grave. In old people and in persons addicted to excesses in alcohol, spasmodic pain in the stomach should be regarded as a dangerous symptom.

Treatment.—The chief indication is to allay the suffering. This can sometimes be effected by removing the cause. When indigestible food is present in the stomach or bowels an emetic in the one case, and a dose of castor-oil with opium in the other will often suffice. When due to fermentation or to undue acidity in the stomach, a combination of alkalies with vegetable bitter infusions and opium is required. For spasms or cramps in the stomach, antispasmodics with opium may be prescribed and repeated every half-hour till the pain is relieved. Brandy, camphor, ether, assafœtida and ammonia will sometimes afford relief. Counter-irritation as by mustard plaster or turpentine stupes is always useful. Warmth may be applied to the extremities by means of hot bricks or bottles of hot water. When vomiting is severe it may be allayed by hydrocyanic acid. The pain dependent on flatulence can be best relieved by rhubarb and magnesia, combined with peppermint or ginger or other carminatives. That caused by misplaced gout needs careful attention. Large mustard plasters should be at once applied to the epigastrium and to the legs, and an aperient of rhubarb and magnesia may be prescribed. When the gastralgia is supposed to be a purely nervous disorder the galvanic current may be tried. If a malarious origin be suspected quinine should be given. Salicin in fifteen grain doses has been given with benefit; small doses of Fowler's solution may also be tried. When the pain frequently recurs, the cause, which often lies in errors in diet or in weakness of the stomach, must be sought for and removed. The regulation of the diet is a point of great importance. All indigestible substances should be avoided.

Hyperæsthesia of the stomach is a condition in which there is increased sensitiveness of the organ when touched. It is a common accompaniment of many gastric disorders. It generally occurs in nervous girls and is worse at the catamenial periods and yields to iron and other tonics as quinine, strychnia, and vegetable bitters. Small doses of arsenic are often very useful and should be given directly after meals. Change of air is often very beneficial.

Vomiting is sometimes a neurotic affection. Such vomiting is

PHLEGMONOUS ENTERITIS.

Phlegmonous enteritis is a kind of enteritis, of great danger and severity. It is characterised by severe pain in the abdomen, and rapidly ends in death.

Causes.—It occurs as a consequence of some mechanical injury. Thus it is an accompaniment of strangulated hernia, intussusception, impaction of a gall-stone, or of stricture. In these cases there is intense inflammation of the affected part of the intestines; the diseased portion, as a rule, is dilated, and contains dark, fœtid fluid. In this affection the inflammatory process affects all the coats of the bowel. Pus collects in the walls of the intestine, and forms distinct abscesses. These burst into the canal, leaving ulcers, or through the peritoneal coat, causing perforation of the intestine.

Post-mortem appearances.—The serous surface presents a general dusky-red, or slaty, or purplish-black appearance. The mucous membrane and the submucous tissue are soft and thick, congested, and present patches of extravasations, and are often covered with adherent lymph. Sometimes they present gangrenous patches, and are infiltrated with pus. The affected part is separated from the portion below it by a distinct, well-defined border of pale and healthy but contracted and empty bowel. The part of the intestine above the diseased portion is also healthy looking, but is dilated, and contains fæcal matter like the diseased portion.

Symptoms.—These vary with the seat, extent, and degree of inflammation. There is inflammatory fever. The paralysis of the inflamed portion of the bowels gives rise to passive dilatation. Its contents are accumulated and prevented from passing onwards, and constipation and vomiting result. The skin is hot, the pulse frequent; the tongue is generally pretty clean at the beginning, but soon becomes thickly coated and dry. The disease is associated with pain and tenderness in the abdomen, and the patient lies with knees drawn up, as in peritonitis. Very often there are tormina at first, which are due to spasmodic movements of the bowels, and they continue afterwards, even though the paralysis is set up, owing to the efforts made by the healthy intestine above the seat of disease to remove its contents. Vomiting is at first purely from the stomach, but it soon becomes stercoraceous, owing to the intestinal obstruction. Hiccough and tympanites are always present in these cases. They are slight at first, but gradually increase, till at last the belly becomes tense and drum-like. This drum-like condition may be due to the extreme distension of the inflamed bowels, to the distension of the healthy bowels above with the fæcal contents, and to the matters contained in the stomach, and it is occasionally black or dark-coloured as in cancer and yellow fever. In these conditions blood is often passed in the alvine evacuations, and the stools are dark-coloured or pitchlike.

In the majority of cases hæmatemesis is the consequence of some lesion in the stomach or in the neighbouring viscera, as the spleen, liver, and pancreas. Hæmorrhage may proceed from the mucous surface of the stomach, or from that of the duodenum or œsophagus. There are three pathological conditions, to any of which hæmatemesis may be due. These are (1) rupture of the over-filled blood-vessels without change of structure; (2) rupture of diseased vessels; (3) diseases of the blood, so that transudation takes place through the vessels.

Arterial fluxion is a rare cause of hæmorrhage. It occurs in inflammation of the stomach, and chiefly in the advanced stage. Hæmatemesis setting in shortly after a meal is a common symptom in ulcer of the stomach. The quantity varies from a mere streak to several ounces. The ulcer most commonly opens into the splenic artery, but when adhesions are formed with the pancreas or liver the opening may take place into the blood-vessels of these viscera. Gastric hæmorrhage occurs in rare cases without pain and without vomiting. In aneurysm the hæmorrhage is always profuse. Hæmorrhage into the stomach may be due to cancer, corrosives, and irritant substances, or foreign bodies, and to external violence, as a blow upon the epigastrium.

Hæmatemesis is a common symptom of congestion of the portal system. Marked cases of this kind occur whenever there is plugging of the portal vein or its large branches by emboli or cancerous matter. Hæmorrhage from hyperæmia of the gastric mucous membrane is ordinarily due to cirrhosis, chronic congestion, or other diseases of the liver. Hæmatemesis sometimes occurs in persons suffering from mitral obstruction, and it may be vicarious to menstruation. In cirrhosis of the liver hæmatemesis is accompanied by symptoms referable to the hepatic region, and by those of chronic gastritis. The blood vomited is dark and grumous. The stools are dark, offensive, and loose. There is often accompanying dropsy (ascites) and general anasarca.

Hæmatemesis sometimes occurs in cases where there is a tendency to hæmorrhage generally. The mucous membrane of the stomach is more or less congested, and the vessels are weak and the blood is altered in composition. Such hæmorrhage is common in the hæmorrhagic diathesis, in purpura, and in the advanced stage of malarious and yellow fevers.

On post-mortem examination it is sometimes difficult to find the

2. *Ulcers due to necrosis of the tissue* and to the action of intestinal secretions upon the mucous membrane. They are mostly found in the duodenum and in its upper third. They are often connected with extensive superficial burns. In amyloid degeneration such a variety may be found in the ileum and colon.

3. *Ulceration of new growths.*—Tubercular and typhoid growths, and also syphilitic gummata affect the intestine, and are prone to ulceration. The tubercular and typhoid growths at first affect the solitary and agminated glands.

Characters of ulcers generally.—They differ with the cause and the duration.

Number.—They may be single, as the duodenal ulcers, or numerous, as follicular ulcers of the colon. Tubercular and typhoid ulcers are numerous, and are chiefly found where the agminated glands abound, as in the lower part of the ileum.

Size.—Where the ulcers are of long duration they invade a large tract of the mucous membrane, extending over many inches. The ulcers are of various sizes, and are separated from each other by a congested or undermined band of mucous membrane. Small ulcers often coalesce and form large ones. The catarrhal and follicular ulcers are extremely small. When the ulcers are numerous and large the muscular fibres are exposed to view, and the mucous membrane presents only a trace of red and swollen excrescences. Ulcers which result from the action of intestinal secretions upon the diseased membrane are known as peptic ulcers. These are characterised by a clean-cut or punched appearance; the edges are sloping and slightly thickened; the surrounding mucous membrane is healthy. Other kinds of ulcers are somewhat irregular in form, their margins congested and ill-defined, edges thickened, and frequently overhanging the base. The surface is covered with a greyish discharge; the surrounding tissues are thick and indurated. The base will depend upon the depth and course of the ulcer; it may be formed of the muscular or of the peritoneal coat, which may be much thickened, or of adjacent structures with which adhesions may have been established. In ulcers due to tubercular or malignant growths the floor is covered with small nodules of the neoplasm. Old-standing ulcers are generally found to be covered with an ash-grey slough; such ulcers are common in dysentery. Tubercular ulcers will be separately described.

Typhoid ulcers are limited to the solitary glands and to Peyer's patches; they present ragged, irregular edges, and vary greatly in size; they are longitudinally situated, corresponding to the length of the bowel; their course is generally acute, and the lesion rarely spreads much beyond the area of the patch.

Dysenteric ulcers are at first small, circular, and with rounded edges. Gradually they become larger and irregular, and present flat margins, their edges being often adherent to the base.

Syphilitic ulcers are hard at the edges and base, and are chiefly found in the neighbourhood of the inlet and outlet of the alimentary canal, and they are generally the result of gummata, which degenerate and break down. They often lead to stricture of the rectum.

Cancerous ulcers are covered with fragments of the neoplasm. Their edges are thick, indurated, and irregular, and studded with fungous growths. The rectum is their most common seat.

Progress.—In acute cases the ulcers either heal in a few days or run on to perforation. In a chronic form they may last for years. The catarrhal, follicular, and other inflammatory ulcers are generally acute, and have a tendency to heal. The typhoid and those due to the action of intestinal secretions upon the membrane are also acute in their nature, but they are especially apt to perforate the bowel. Large ulcers may remain open for some time, and are liable to reopen, even if healing takes place. Their cicatrisation gives rise to constriction, as is often seen in chronic dysentery. Subacute peritonitis is another result, and produces adhesions between neighbouring portions of intestine. In chronic ulcers the base is thickened by newly-formed connective tissue, and the deeper the ulceration the more prone are the cicatrices to contract.

Symptoms.—The symptoms connected with intestinal ulcers are often very indefinite. In many cases the symptoms are those of the associated conditions, or of the resulting complications. As a general rule the severity of the symptoms is no measure of the extent of mischief; they are often marked in typhoid ulcers that generally heal, whereas in perforating ulcers there may be no symptoms till within a few hours of death. I have lately witnessed a case of this kind occurring on the fourteenth day after severe burns in a Parsee boy, aged eight years. Where ulceration depends upon enteritis or new growths, the symptoms are those of vomiting, local pain, and tenderness and fever. Diarrhœa is not always present even with extensive ulceration. Constipation sometimes exists. Jaundice is present in cases of duodenal ulcers if the opening of the bile duct be involved. Chronic ulcers are often attended with hectic fever, some impairment of general nutrition, emaciation, and debility. There is more or less tenderness in the affected part. Other symptoms vary with the seat of the ulcer. In those seated in the duodenum the symptoms nearly resemble those of gastric ulcers, there is localised pain some time after food, and vomiting. If the ulcers are seated in the small intestines the symptoms are those of gradually increasing emaciation, colicky pains, and constipation of the bowels. If the ulcers are present in the large intestines there is diarrhœa. The motions are liquid, fœtid, and contain abnormal secretions of the bowels, mixed with more or less blood, and are often attended with colicky pain and straining. Where the ulcers approach the lower part of the large intestines the stools become more and more dysenteric, are scanty, and contain mucus and blood, often without any feculent matter, or with a few scybala covered by mucus, passed with extreme frequency and with great tenesmus and pain. The odour is very offensive. Sometimes hæmorrhage from the bowels occurs. If the blood is bright red it is generally characteristic of ulceration, but it may be due to chronic congestion.

Prognosis.—This, as a rule, is very unfavorable. In typhoid ulcers the prognosis depends upon the general state of the patient at the time. In tubercular ulcers the prognosis is extremely unfavorable; the ulcers never heal, and by their development hasten death. Ulceration of malignant growths is sometimes salutary, as it tends to remove the mass, and to diminish obstruction. In chronic ulceration the health generally fails and constriction is likely to occur; the prognosis is very unfavorable.

Treatment.—The treatment of intestinal ulcers is for the most part of a general character. In every case the complications require attention. As there is a tendency towards perforation undue movements of the bowel should be prevented as far as possible. Opium is useful to allay irritation in primary ulcers. In other respects the treatment consists in keeping the parts at perfect rest, and thus promoting healing of the ulcers. Those remedies which promote cicatrisation as bismuth, nitrate of silver, preparations of iron, sulphate of copper, and the mineral acids, may be given with benefit. These may be combined with hyoscyamus or belladonna. Good, well-cooked food should be taken frequently in small quantities, and should be well masticated. Arrowroot, milk, and eggs are serviceable.

TUBERCULAR DISEASE OF THE INTESTINES.

The bowel is a frequent seat of grey granulations or miliary tubercles. These growths being a local development of lymphoid tissue find a suitable nidus in the submucous coat of the intestine and in the solitary and agminated glands. The development and spread of tubercles are also favoured by the abundance of lymphatic vessels in the intestines. As a primary growth, tubercles in the

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over the abdomen; they often set up peritonitis as a result of irritation. In every case marasmus is a characteristic symptom. The patient becomes anæmic and suffers from hectic. Death from asthenia is the common result, but when the glands become calcareous recovery follows.

Treatment.—That of the scrofulous diathesis should be adopted. The patient should have cod-liver oil, pancreatic emulsion, preparations of iron, quinine and other tonics. Change of air, sea bathing, and exercise in the open air will be very serviceable. Attention must be paid to the diet. It should be nutritious, easily digestible by the stomach, and taken in small quantities and repeatedly. Any urgent symptoms will require relief. Diarrhœa should be checked by enemata of starch and opium, or of acetate of lead and opium. The other abdominal symptoms may be relieved by fomentations or poultices, or by a flannel bandage.

Albuminoid Disease of the Intestines.

It is a degenerative disease occurring when the same affection has far advanced in other organs, as the spleen, liver, kidneys, and lymphatic glands.

Morbid appearances.—The inner coat of the intestinal arteries, and especially of those surrounding the solitary and agminated glands, undergoes albumenoid change. The glands for a long time resist the degenerative change, but ultimately become involved. The mesenteric lymphatic glands are also affected. All the coats of the bowels are replaced by this new material. The mucous membrane appears tough, pale, and thick, and in extreme cases ulcers form. The ileum is the favourite seat of this disease.

Symptoms.—The chief of these are diarrhœa and hæmorrhage. Other symptoms refer to the complications. The diarrhœa is persistent, and the evacuations are generally fluid, and often greenish from altered blood. There is no pain or tenderness. Hæmorrhage frequently occurs.

Treatment.—This is only palliative. Enemata of starch with opium often give relief.

Diseases of the Colon.

Lesions of the colon are sometimes connected with dysentery, typhoid fever, enteritis, and peritonitis. A common affection of the colon is known as *atony*, which is due to loss of contractile power of its muscular coat. Inflammation, otherwise known as *colitis*, is a local non-specific lesion attacking the submucous and

mucous coats. Displacements of the transverse portion and of the sigmoid flexure are sometimes met with. Diverticula loaded with fæces sometimes form distinct tumours.

Atony.—In this condition there is diminished contractile power of the muscular coat. As a result there is retention of fæces and gases, and constipation.

The *causes* of atony are the same as those of constipation. When once the condition is established, the loss of contractile power increases. Paralysis of the sympathetic nerve is a cause of tympanitic distension of the abdomen as occurs in peritonitis and typhus.

Symptoms.—The flatulent distension and large fæcal accumulations impede the descent of the diaphragm and thus lead to dyspnœa, palpitation, &c. The disturbed circulation in the brain gives rise to giddiness and headache. The distended colon pressing on the veins may cause numbness and cramps in the lower limbs. The digestion becomes deranged and the liver is also disordered. The general symptoms are due to the absorption of excrementitious materials. These are sallow, earthy complexion, lassitude, offensive breath, and loaded urine.

Treatment. — Constipation being the chief factor in causing atony, it should be remedied by hygienic and dietetic measures and also by medicine. The principal drugs to be relied on are tonics as iron, quinine, and strychnia combined with aperients as aloes, colocynth, and podophyllin. Belladonna may be added with advantage. Locally the measures already recommended for the treatment of constipation may be employed. The flatulent distension so common in females is best relieved by compound assafœtida pills and nux vomica.

Colitis.—The disease is often mistaken for dysentery. Up to a certain point the lesions are the same in both affections. In colitis the inflammation is non-specific and commences in the submucous tissue and then extends to the mucous membrane and the gland structures. In dysentery, the inflammation begins in the glands and is specific in character.

The catarrhal form of colitis sometimes accompanies measles. It is characterised by glairy bloody stools and tenesmus. Colitis often results from retained excreta in a limited portion of the colon, and from extension of typhlitis. In fæcal retention, the mucous follicles of the colon become obstructed and colitis may result.

Treatment.—The inflammation can be subdued by fomentations or poultices; the pain may be relieved by opiate enemata or by morphia suppositories. Feculent retention may be treated with

intestines are frequently met with in children as a part of general tuberculosis. In adults the affection is generally associated with phthisis and is secondary to it.

Morbid appearances. — The tubercles at first invade the submucous tissues and the peritoneal coat, the ileum and the cæcum being the parts especially affected. In the duodenum and jejunum they are very rare. In the stomach they are never found. In scrofulous children, who die of acute tuberculosis, numerous grey granulations are found in the solitary and agminated glands and in the submucous tissue. In advanced cases the granulations form masses, which undergo cheesy metamorphosis and break down, giving rise to tubercular ulcers. Such ulcers are characteristic. They readily spread, but seldom heal, and they invade the intestine in a direction round the bowel. Incomplete cicatrization is often found. The extension of a tubercular ulcer is preceded by a development of fresh tubercles, which pursue a similar course. The union of several ulcers may cause great loss of substance both superficially and deeply. Perforation is rare, inasmuch as adhesions are generally formed. The edges of the ulcers are irregular and thickened and are studded with miliary tubercles.

Symptoms.—In the early stages in strumous children it may be difficult to decide whether the case is one of intestinal catarrh or cheesy metamorphosis and ulceration. The case is suspicious if the passages be preceded by pain, the abdomen is sensitive to pressure, the fever lingering, and there is diarrhœa. Sometimes diarrhœa disappears for a time, but there are soon again frequent copious fluid stools. Tuberculosis may last for years; the thinness of the motion depends upon the catarrh, which varies in intensity. The symptoms are those of ulceration of the bowels in general. When the tubercles are limited to the ileum there will be pain, tenderness, and griping in the iliac fossa, and the bowels may be irregular. If the large intestines are diseased the symptoms will be those of dysentery. Tuberculosis of the intestines is a progressive disease, and therefore the diarrhœa is intractable; the patient rapidly loses flesh and strength, and in advanced cases suffers from night sweats and cold extremities; there are also symptoms of tubercles in other organs. Hæmorrhage occasionally takes place, and death most often results from lung disease.

Treatment.—Very little can be done with a hope of cure in these cases. Owing to the presence of tubercles in the intestines, the digesting and absorbing surface is considerably lessened, and the food is not assimilated unless it be of a nature to be easily digested in the stomach. Opiate enemata often check the diarrhœa, but the effect is temporary. Hæmorrhage often sets in and can be

phuric acid, and by enemata. Castor-oil with turpentine and a drop of croton oil are useful purgatives. In this disease diluted sulphuric acid has been recommended in order to convert the lead into the sulphate, and iodide of potassium should also be given as an eliminant. In advanced cases purgatives should be avoided, and the bowels should be kept at rest, or may be acted upon by gruel or warm-water enemata. Alum is supposed to detach lead from the albuminates in the tissues, and to form a soluble compound, which is excreted by the kidneys.

During convalescence from lead colic the bowels should be acted on by enemata of castor-oil and turpentine. A generous diet with exercise in the open air is necessary. Strychnia, with various bitter infusions and pills of aloes and myrrh from time to time, are likely to be useful. Where colic is caused chiefly by change in the structure or position of the bowels emollient injections should be persevered with and the action of the bowels promoted by oleaginous aperients.

CONSTIPATION.

This subject has already been discussed (see vol. i, pp. 103—105). Its causes and symptoms have been sufficiently described; it remains now to point out the treatment of the various forms.

In treating cases of constipation the cause should be discovered, and if practicable removed. The constitution and habits of the patient and the complications must be attended to. The treatment should be directed towards procuring fæcal evacuations by gentle and unirritating means. This is done by rendering the muscular coat of the large intestines competent to fulfil its functions, and by restoring the sensibility of the lower part of the bowels. The calls of nature should be attended to every day and at one particular time. The desire should never be disregarded and the performance of the duty never postponed or hurried. Constipation when actually present must be dealt with by attention to the diet and habits, and by exercise, medicines, and mechanical means. Habitual constipation may be much relieved by the adoption of a regular and proper diet. The food should be digestible and wholesome; a large variety of dishes should be avoided. Animal food should be taken once or at most twice daily. Bulky or starchy food such as bread, biscuits, rice, and sago should be taken in great moderation. Green vegetables are useful; brown bread with honey or treacle agrees with many persons, and may be recommended. Strong coffee or tea should not be given. Certain articles increase the peristaltic movements of the intes-

over the abdomen; they often set up peritonitis as a result of irritation. In every case marasmus is a characteristic symptom. The patient becomes anæmic and suffers from hectic. Death from asthenia is the common result, but when the glands become calcareous recovery follows.

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Symptoms.—The flatulent distension and large fæcal accumulations impede the descent of the diaphragm and thus lead to dyspnœa, palpitation, &c. The disturbed circulation in the brain gives rise to giddiness and headache. The distended colon pressing on the veins may cause numbness and cramps in the lower limbs. The digestion becomes deranged and the liver is also disordered. The general symptoms are due to the absorption of excrementitious materials. These are sallow, earthy complexion, lassitude, offensive breath, and loaded urine.

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The catarrhal form of colitis sometimes accompanies measles. It is characterised by glairy bloody stools and tenesmus. Colitis often results from retained excreta in a limited portion of the colon, and from extension of typhlitis. In fæcal retention, the mucous follicles of the colon become obstructed and colitis may result.

Treatment.—The inflammation can be subdued by fomentations or poultices; the pain may be relieved by opiate enemata or by morphia suppositories. Feculent retention may be treated with

castor-oil and opium. In the ulcerative stage the injection of a solution of nitrate of silver, gr. j to ℥j of water, is the best remedy.

DISEASES OF THE CÆCUM.

The morbid conditions connected with the cæcum are accumulation of fæces, and inflammation of the walls, otherwise known as *typhlitis*. Where the inflammation extends into the cellular tissue behind the cæcum the disease is known as *perityphlitis*.

Accumulations.—Hardened fæces, worms, intestinal concretions, and gases resulting from decomposition not unfrequently collect in the cæcum and set up various disturbances. In such cases the right iliac region is full and hard, the tumour is well defined and feels doughy to the touch; it is painless and resembles in shape the form of the cæcum. The accumulation may end in more or less complete obstruction of the bowels, and it sometimes causes peritonitis. Numbness and œdema of the right leg and retraction of the right testicle are also observed. In a few cases typhlitis results.

Typhlitis.—In this disease the inflammation affects the muscular and mucous coats of the cæcum. Typhlitis is liable to end in perforative ulceration, peritonitis, and in perityphlitis.

Causes.—The anatomical peculiarity of the cæcum predisposes it to fæcal or other accumulations; the retention of fæces or foreign bodies for a long time gives rise to inertia of the large intestine. The exciting causes are exposure to cold and ingestion of various irritating articles.

Morbid anatomy. — Perforation of the cæcum, or vermiform appendix, more or less diffused peritonitis, adhesions, and in some cases, abscesses are the principal changes observed in fatal cases. The inflammation may be either propagated from other parts or may be limited to the cæcum. In the catarrhal form, the exudation becomes absorbed and recovery results. In other cases the inflammation is more severe; the exudation sometimes leads to diffuse necrosis of the connective tissue and ulceration or abscesses result, and give rise to perforation.

Symptoms.—These are pain and tenderness in the right iliac fossa, generally associated with rigors and fever. There is usually some previous history of intestinal derangements. The pain is continuous, increasing on pressure and on movement, as by deep inspiration and coughing. Owing to extreme tenderness, the patient lies on the right side and the knees are drawn up. There is fulness and hardness in the cæcal region. Where typhlitis is due to fæcal accumulation there is a defined tumour occupying the cæcum. In other cases there is only fulness at first; after a time a tumour is formed. This is generally ill-defined, the lower part is distinct, the upper portion running into the ascending colon. The abdomen is also enlarged. Vomiting is often urgent and may become stercoraceous. In such cases the pain is also very severe. When the inflammation extends over the colon the constipation will be replaced by diarrhœa and there will be great tenesmus.

Terminations.—In favorable cases the disease ends in resolution during the second week. All the symptoms subside and the bowels are copiously relieved.

In unfavorable cases the disease may, after a tedious course, end in abscess or in inflammation of the cellular tissue behind the cæcum, or may lead to peritonitis. The abscess may open externally, or into the rectum, or the matter may pass down the course of the psoas muscle, and point at the upper part of the thigh. Where it opens it often leaves a sinus. Should the abscess perforate the peritoneal cavity, fatal peritonitis results; when it opens into the surrounding connective tissue, it gives rise to perityphlitis, which is known by pain and firm swelling in the cæcum, with redness and superficial œdema of the skin.

Diagnosis.—A tumour, an inflammatory morbid growth, a mere abscess of the skin, simple distension or impaction of the cæcum by fæces, may simulate typhlitis or perityphlitis. In *tumours* of the skin the swelling, pain, and tenderness are superficial. In *abscess* of the skin there is, in addition, superficial redness. In these affections there is no tenderness from the first, the bowels are not affected, there is no mucus, no pus in the stools, and the peritoneum is never perforated. All these symptoms are found in typhlitis. Simple *distension or impaction* is relieved upon the free action of the bowels, and the onset is not so sudden as in typhlitis. There is also no fever and no marked local signs in the right iliac fossa. In *inflammatory growths*, as of the right ovary, there is local peritonitis due to that cause, and the local symptoms are seated nearer the middle line, and not in the right groin; there is no constipation, and there is history of disordered menstruation.

Prognosis is generally favorable; it depends upon the complications or sequelæ. Ulceration of the cæcum or perityphlitis may be suspected if after constipation and vomiting have subsided the signs of local inflammation persist.

Treatment.—This consists in subduing the inflammation by leeches, fomentations, poultices, and rest. If typhlitis be due to accumulated fæces or intestinal concretions, aperients or laxatives, combined with opium, are indicated. Large warm-water enemata are highly useful. All strong purgatives should be avoided, as they increase the inflammation and, by setting up further irritation, may lead to perforation. The diet should be liquid, given in small quantities and repeatedly.

DISEASES OF THE RECTUM.

Diseases of the rectum form a numerous class, but the lesions are mostly seated within two inches of the anus. The principal diseases are for the most part of a surgical nature, and require only a passing notice.

Fistula in ano.—The most common cause of this affection is the formation of an abscess in the loose areolar tissue round the lower part of the anus. The abscess bursts, leaving a fistula, which is indicated externally by a button-like growth with a central opening. When a sinus exists communicating with the external integument and with the rectum, the fistula is described as complete; when there is no external opening, the case is one of blind internal fistula. The abscess often burrows, and may extend in the direction of the buttock or the perineum. Fistula also results from a phlegmonous abscess, and from an ulcer within the external sphincter. In cases of tubercular ulceration, as occurs in phthisis, the opening is often found very high up in the bowel. The treatment of fistula falls within the province of the surgeon.

Malignant diseases of the rectum.—The rectum is sometimes the seat of cancer and sarcomatous growths, which more or less block up the passage. They are liable to spread and to invade adjoining parts. They are generally found in the lower part of the bowel, within three inches of the anus. The disease is more common in men than in women, and after middle life.

Symptoms.—These are similar to those of stricture of the rectum. The whole of the diseased gut becomes thick, contracted, and indurated. The patient has difficulty in passing stools, and suffers from flatulence and pain about the sacrum, extending down the thighs. The motions are generally loose, thin, serous, and frequent, and contain blood, and are passed with scalding. The destruction of the sphincter and of the nerves supplying the muscle leads to involuntary discharge of fæces. The patient gradually loses flesh and strength, and sometimes complete obstruction occurs, ending fatally. Death is generally due to exhaustion.

Treatment.—This is only palliative. The pain must be relieved by sedatives, and especially by morphia subcutaneously injected, or in the form of a suppository. Excision of a portion of the bowel and colotomy are sometimes performed in these cases.

Stricture of the rectum.—The stricture may be limited in extent, When the intestines are very weak they are unable to expel the gas, and it becomes a source of great misery and discomfort.

Diarrhœa, cramps, and flatulence are also the result of fermentation. Where digestion is not properly effected in the stomach fermentation takes place in the undigested food after it has passed the pylorus. During health the mucus secreted by the gland follicles of the intestines assists further digestion; where this is not effected fermentation is the consequence. Like the gastric juice, the bile is an agent which controls and prevents putrefaction. The food, after it has passed the stomach and entered the duodenum or the jejunum, is highly acid, owing to the predominance in it of the acids of the stomach. The acid greatly diminishes, and even disappears, as it reaches the cæcum. In the large intestine the contents are generally alkaline. If the food in the intestine undergoes putrefaction gas is evolved, and flatulence, uneasy sensations in the bowels, as colic, and even spasmodic pain from the irritation or obstruction of the bowels result. Further irritation of the bowels leads to increased mucous secretion and to diarrhœa and vomiting.

Intestinal Flatulence—Tympanites.

Intestinal flatulence, its causes and symptoms, have been already described (see vol. i, page 94) in the chapter on the general symptoms of diseases of the alimentary canal. It remains to indicate the *treatment* to be pursued.

In intestinal flatulence when the gas is imprisoned, enemata containing assafœtida or turpentine are very useful. A long tube should be used. Rhubarb with extract of nux vomica may be given internally. Locally, friction to the abdomen with stimulating liniments and the application of mustard poultices will help to dislodge the flatus. Gentle kneading of the most distended parts also gives relief. Various stimulants as ammonia, ether, and spirit of chloroform, and aromatic carminatives, as cloves, ginger, camphor, and cajeput may be given with advantage. In extreme cases puncturing the colon may be tried. All food likely to ferment should be avoided, and after the acute symptoms have subsided various remedies should be given to check fermentation. The sulpho-carbolates, creasote, and charcoal are often useful. Alkalies with nux vomica are suitable for many cases. Constipation must be prevented by suitable aperients. A combination of aloes, quinine, and belladonna is often very serviceable.

INTESTINAL COLIC AND ENTERALGIA.

Both these affections are the result of irregular, unnatural, or spasmodic contractions of the muscular fibres of the intestines. Enteralgia is a neuralgic affection of the sensori-motor nerves of the mesenteric plexus. The term includes all kinds of pain in the belly, especially about the umbilicus, without any constitutional febrile disturbance. It includes colic proper, which is a visceral neuralgia, and can well be exemplified by the symptoms often due to lead. The term enteralgia is generally applied to paroxysmal pain in the intestine as occurring in neurotic, anæmic, and gouty subjects, and to symptoms in which pain is present rather than spasm. The clinical phenomena are the same as those of colic.

Colic is characterised by severe paroxysmal and twisting pain in the belly, especially about the umbilicus. The pain is relieved by pressure; it is often accompanied by constipation, occasionally by diarrhœa and vomiting. The abdomen is either distended or retracted. There is no febrile disturbance.

Causes.—These are, morbid states of the bowels, and include some of those conditions which give rise to changes in the structure or in the position of the intestine. Thus it is common in obstruction from intussusception, twisting, and strangulation; in ulceration from any cause; in inflammation, as enteritis and typhlitis. Colic from other causes is most apt to occur in nervous, hysterical, and hypochondriacal patients. Young persons and adults are more liable than others, and females are most often attacked. The most common causes of colic are irritating substances contained in the intestines, such as indigestible food, perverted secretions, and the like. Other sources of irritation are the presence of worms, gall-stones, and of fæcal accumulation. Exposure to cold and the use of cold drinks are liable to cause this symptom in some persons. Lead colic has been already referred to (see vol. i, p. 209). Another cause of colic is reflex irritation as due to diseases of the uterus or ovaries, to biliary or renal calculus, to dentition, anxiety, or other mental emotions.

Symptoms.—The condition may be acute or chronic. In either form the characteristic symptom is pain, which is more or less severe and paroxysmal. Besides pain there is distension of the abdomen and constipation. The expression is one of great suffering; the skin is cold and covered with perspiration. The pulse is normal and feeble; there is no fever. The symptoms vary with the cause. In nervous colic the pain is sudden, abrupt, and shifting, and occurs at irregular intervals. In some cases the pain is confined to the umbilicus, where it generally begins. Its duration tissues round the rectum, their high vascularity, their great liability to congestion, and likewise to injury. The inflammation often runs on to suppuration, and may be either acute or chronic. Acute inflammation may be due to direct violence, or to the presence of some foreign body accidentally or intentionally introduced. In persons suffering from stricture of the urethra unskilful catheterism may set up periproctitis. It is often provoked by sharp substances which have been swallowed, and by wounds or falls by which the parts are injured. It sometimes occurs as a result of extension of inflammation from neighbouring parts. Ulcers of the bowel give rise to a very severe form.

Chronic periproctitis generally results from extension of inflammation from the surrounding parts. In this form there is considerable thickening of the cellular tissue, and sometimes suppuration. Ligature of hæmorrhoids sometimes leads to pyæmia, which may be attended with periproctitis.

Symptoms.—The patient complains of heat, a feeling of weight and pain round the anus, with spasm and over-sensitiveness of the sphincter ani. During defæcation the pain increases. The stools are dark-coloured, contain gelatinous mucus, and are passed with tenesmus. On passing the finger into the rectum the part is felt to be hot and tender, and local hardness or fluctuation is discovered. The thickness of the skin and the fasciæ prevent the mischief from coming to the surface. In chronic cases there may be some disease of the sacrum or coccyx.

Treatment.—In acute cases a few leeches round the anus with antiphlogistics may be required. The bowels should be kept regular and constipation avoided by simple enemata. In all cases the cause must be sought for and removed.

MALIGNANT DISEASE OF THE INTESTINES.

Malignant growths of the intestine are rapidly fatal after producing symptoms of marked emaciation and debility. They are rare before forty. The frequency of carcinoma in the intestine, compared with that in other parts, is one to twenty-five.

Intestinal carcinoma is generally primary, and often runs its course without any secondary formation elsewhere. Occasionally the disease is the result of extension from neighbouring parts. Examples of this are seen in the rectum and duodenum, the disease spreading from the uterus and liver respectively.

Morbid appearances.—Carcinoma often commences in the mucous and submucous coats of the large intestine, especially the sigmoid flexure, cæcum, colon, and rectum. It is rare in the small intestine.

when it subsides the patient complains of soreness of the abdomen, although there is immense relief from the pain. It sometimes ends in enteritis, and in children in intussusception.

Diagnosis of colic generally.—The absence of fever, the relief obtained by pressure, and the shifting character of the pain exclude enteritis or other inflammatory affections. From gastralgia colic is distinguished by the pain occupying a lower position in the abdomen. In gastralgia the percussion note is deep toned and more prolonged. In colic borborygmi can be traced by the hand, and may even be seen, and there is often tenesmus. If enteritis or peritonitis follow colic the pulse becomes frequent, and there is tenderness on pressure. Lead colic is diagnosed by the history of exposure to lead poisoning, and by the other symptoms.

Treatment.—In all cases of colic the cause should, if possible, be ascertained, and the patient should be carefully examined, in order to see whether any tumour or hernia is present. In colic due to errors in diet these must be attended to. If due to excessive use of acids, alkalies combined with anodynes and carminatives are indicated. Where due to the presence of indigestible food a purgative dose of calomel will relieve the symptoms. Rhubarb and magnesia, with carminatives, may be used for milder cases. In infants when the attack is brought on by improper feeding, a little grey powder with magnesia and carminatives will afford relief. If the meconium is retained a few drops of castor-oil, given by the mouth, will suffice. If in children, owing to want of due attention, accumulation of fæcal matter take place, mild laxatives may be given from time to time. In adults, for colic arising from the same cause, an enema of turpentine with castor-oil and assafœtida is often an efficacious remedy. In acute cases the paroxysm may be checked by small doses of calomel, belladonna, and opium. The hypodermic injection of 5 minims of morphia solution (1 grain in 20 minims), and 1 drop of solution of atropine (1 grain in 100 minims) is the best remedy to procure relief from pain. In hysterical cases Tinct. Valerian. Co., with assafœtida may be given with the above. Should the abdomen be tumid hot fomentations, linseed poultices, turpentine stupes, warm baths, or friction with stimulating liniments, may be tried. In cases of copper colic purgatives guarded by opium are indicated. Hot sulphur baths and antispasmodics give relief to the pain. Plenty of milk and light nutritious diet are very useful in these cases. For lead colic the source of the poisoning must be found out, and further exposure prevented. The pain and discomfort may be relieved by opium, belladonna, and antispasmodics, as ether, and by fomentations. The bowels should be freely moved by Epsom salts mixed with infusion of roses, or with an excess of sul-

and is then known as *annular*, or it may involve a large portion of the coats. Above the stricture the rectum is somewhat dilated and hypertrophied. The lesion is generally situated within two inches of the anus, but is now and then found at the junction of the sigmoid flexure and rectum. The mucous coat above the stricture is usually red and ulcerated. Rectal stricture is generally due to chronic inflammation of the mucous membrane and of the submucous connective tissue. In women it sometimes results from injuries produced during difficult labours. In both sexes it is a frequent result of ulceration.

Symptoms.—The patient complains of habitual constipation, and if stools are passed they are solid, or contain only mucus and blood, voided with great straining. As the case progresses, the constipation becomes more marked, the dejections contain slimy mucus of a brown colour, and severe burning pain in the rectum is complained of. If ulcers be present, the evacuations contain pus and blood, and the suffering is extreme. The mental depression is great, but the appetite is not much deranged, and the health is little impaired. In advanced cases there are signs of exhaustion and emaciation, and night sweats are common. Hardened fæces sometimes cause obstruction of the bowel above the stricture. As a rule, in cases of stricture small excrescences, often resembling external piles, are seen round the anus. Stricture of the rectum can easily be detected by the fingers.

Treatment.—In some cases persistent dilatation by means of bougies is sufficient. If the stricture be callous, four or five incisions should be made in different parts of the ring, and the opening kept patent by means of a plug of a roll of lint. The pain may be relieved by anodynes locally applied. In obstinate cases colotomy may be performed.

Prolapse of the rectum.—In true prolapsus all the coats of the bowel, sometimes to the extent of several inches, are protruded, and the gut appears inverted.

Causes.—The disease is common between the ages of two and four, but may occur in later life. It is much more common in women than in men; in the former it is due to the parts having become weakened by childbearing. In infants and children it is produced by long-continued diarrhœa, by worms, and by stone in the bladder.

Symptoms.—At first the protrusion occurs only when the bowels are moved. Later on, it descends on the slightest exertion. In ordinary cases the protrusion forms a globular swelling round the anus, at which part the growth is contracted into a neck. In the centre of the protrusion there is an opening communicating with the canal. Where the prolapse is extensive the swelling appears [illegible] tines and are therefore useful. Fresh fruits as plantains, grapes, oranges, pomegranates, figs (green or preserved), tamarinds, and prunes, taken early in the morning on an empty stomach, are wholesome and in many cases keep the bowels open. The daily use among the Indians of almonds and grapes at dessert is effective in checking constipation. Oils and fats are also useful.

Medicines.—The objects to be gained by medicine are three: 1. To relieve distension of the large intestines by removing mechanical obstruction. 2. To give tone to the muscular fibres of the intestines. 3. To increase the flow of mucus and other secretions. The simplest remedy is a glassful of cold water in the early morning. Where water alone does not succeed, a teaspoonful of table salt or Epsom salts or Rochelle salts may be added. Various mineral waters, as the Friedrichshall or Hunyadi Janos, taken every morning, are well adapted for many cases. A cold douche to the abdomen while sitting in a hip-bath is sometimes useful in giving tone to the bowels. Cold water compresses to the abdomen for some time every morning, and flannel worn next the skin of the abdomen are useful, especially if the belly be pendulous. In habitual constipation small enemata of cold water give relief. In cases where fæces remain lodged in the rectal pouch, relief may be obtained by emollient enemata and by suppositories of soap, or of butter of cocoa. In cases due to atony of the intestinal walls laxatives and purgatives as aloes, colocynth, podophyllin, rhubarb, and gamboge are often employed. These are generally combined with hyoscyamus or belladonna. Nux vomica may be added with advantage. Confection of senna or of tamarind pulp may be given as laxatives. When the object is to excite the glandular secretion and also increase the peristaltic action of the muscular fibres of the large intestine, strong doses of these medicines should not be given, as they produce a violent purgative action at first, but are soon followed by torpor, or exhaustion of the bowels. The aperients should after a time be replaced by tonics, as iron and nux vomica combined with belladonna or atropia. Belladonna is in high repute in such cases. Where the small intestines are chiefly affected, senna and rhubarb with alkalies are the best remedies. If the biliary secretions are at fault blue pill or calomel or podophyllin may be given in small doses. Gentle aperients as senna or sulphur combined with a little belladonna, or pills of aloes combined with sulphate of iron often succeed where other remedies have failed. Pulvis Glycyrrhizæ Comp. is a good combination.

For persons of weak constitution rhubarb and taraxacum with quinine may be prescribed. Castor-oil is very valuable as an adjunct to tonic treatment, and may be given every few days. In some tissues round the rectum, their high vascularity, their great liability to congestion, and likewise to injury. The inflammation often runs on to suppuration, and may be either acute or chronic. Acute inflammation may be due to direct violence, or to the presence of some foreign body accidentally or intentionally introduced. In persons suffering from stricture of the urethra unskilful catheterism may set up periproctitis. It is often provoked by sharp substances which have been swallowed, and by wounds or falls by which the parts are injured. It sometimes occurs as a result of extension of inflammation from neighbouring parts. Ulcers of the bowel give rise to a very severe form.

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Morbid appearances.—Carcinoma often commences in the mucous and submucous coats of the large intestine, especially the sigmoid flexure, cæcum, colon, and rectum. It is rare in the small intestine.

It is most often met with in the flexures of the colon, where delay occurs in the passage of the intestinal contents. It commences at a certain spot, and then invades the whole thickness of the walls. It also implicates the mesenteric and the neighbouring lymphatic glands, and extends into other parts.

The varieties of carcinoma affecting the intestine are scirrhus, medullary, encephaloid, and colloid. The colloid form begins in the peritoneum, and then extends inwards. Other growths are epithelioma, lymphadenoma, and adenoma. All these growths have a tendency to degenerate and ulcerate.

Course.—The diseased part often sinks, and is fixed by adhesions to other parts. The cancerous growth forms an irregularly-shaped mass, varying in size and consistence, and obstructing the canal of the bowel to a greater or less extent. Ulceration is a constant accompaniment. The growth sometimes spreads in an annular manner, and almost obliterates the canal. If sloughing takes place some enlargement may follow, to be succeeded by constriction at a later stage. Above the stricture the intestine is dilated, filled with fæces and gas; its wall is hypertrophied, its mucous membrane inflamed, and below the stricture the canal is collapsed.

Symptoms.—The disease cannot always be diagnosed with certainty. For some time the patient may complain of nausea and vomiting. The belly is puffed up and there is habitual constipation and signs of intestinal obstruction. In exceptional cases the bowel becomes dilated, and there is diarrhœa alternating with constipation. The stools are characteristic of stricture; the scybala have an abnormal shape and size; ultimately the patient passes much mucus and blood mixed with sloughed portions of cancer. Other characteristic signs are marked cancerous cachexia and rapid wasting. If the peritoneum is affected, peritonitis is present. Ascites is a usual complication of colloid cancer.

With regard to the local signs a tumour can sometimes be felt. This is hard, irregular, and somewhat nodular, and either moveable or fixed. There may be ill-defined fulness in one region. The growth is generally felt on the left side of the abdomen. On percussion of the abdomen the sound is tympanitic, owing to the coils of intestines intervening between the growth and the abdominal walls. Pain is often wanting; when present it may be localised and of a dull character. When the disease affects the sigmoid flexure and rectum there is very severe localised pain.

Terminations. — The disease is progressive and always ends fatally. The average duration is estimated to be eighteen months. Death may result from exhaustion, from hæmorrhage, or from peritonitis.

Diagnosis. — This is sometimes extremely difficult, both as regards the seat and the presence of cancer. Difficulty in the diagnosis arises from the insidious nature of the symptoms. The progressive character of the disease, the cachexia, and its resistance to treatment, point, however, to cancer. In the later stage, when no tumour can be detected, it is often mistaken for chronic enteritis. Many of the symptoms resemble those of diseases of the suprarenal capsules, but there is no discolouration of the skin. A cancerous tumour of the bowels may be mistaken for one connected with the liver, pancreas, mesentery, kidney, or uterus, or even for fæcal accumulation, or an aneurysm. In intestinal cancer, the history, age, progressive emaciation, signs of obstruction, and the character of the evacuations are the points which determine the diagnosis.

Treatment.—The treatment is only palliative. The diet should be liquid, nutritious, and such as can readily be digested by the stomach. Broths, eggs, and milk are required. The symptoms dependent upon obstruction may be relieved by laxatives. If bleeding occurs it may be checked by astringents. Pain may be relieved by morphia hypodermically injected. Colotomy may be performed if there is cancer in the rectum or sigmoid flexure.

HÆMORRHOIDS.

Hæmorrhoids are of two main kinds, external and internal, the former being the more common, and presenting two varieties. The first variety of external hæmorrhoids consists of hypertrophies or excrescences of the skin; the second, of sanguineous, venous tumours.

Causes.—These are of various kinds, the chief of them being obstruction of the liver or portal system, fæcal accumulation, or anything interfering with the free return of blood from the rectal veins. The anatomical peculiarities of the structure of the part predispose to venous enlargements. Among other causes may be mentioned excesses in eating and drinking, sedentary occupations, uterine displacements, straining, however induced, and neglect of proper ablutions.

Symptoms.—External hæmorrhoids in an uninflamed state are scarcely noticed by the patient. They appear as small pendulous flaps of skin, or as little tumours resembling varicose veins. In an inflamed state these are much increased in size, [illegible] and very painful; the venous hæmorrhoids form [illegible] globular tumours. They give rise to a constant sense of throbbing and to spasm of the sphincter and levator ani muscles. The patient [illegible]

Exciting causes.—These at first lead to hyperæmia and subsequently to inflammation. The most common are local irritants, such as improper food and various drugs and poisons. Exposure to cold, wounds, impacted fæces, and gall-stones are other causes of this disease. It sometimes arises as a result of burns, of inflammation of neighbouring parts, and during the course of acute infectious diseases.

Post-mortem appearances.—The catarrh very seldom affects the entire intestine. It is most frequent in the colon, cæcum, and rectum. It is less common in the duodenum and ileum, and comparatively rare in the jejunum. The mucous membrane is hyperæmic, the redness varying from pink to a dark red. The increased vascularity sometimes leads to capillary rupture and formation of petechiæ on the mucous surface. The tissue changes are well marked. There is swelling of the epithelial cells, which are also proliferated. The connective tissue is also increased and full of leucocytes, which form the pus-corpuscles. In inflammation of a specific form, as in diphtheria, the newly-formed cells are contained in a fibrinous coagulable exudation, and form membranous patches adherent to the surface of the intestines. In all cases there is œdema of the intestinal walls from infiltration of serum. The free surface of the mucous membrane is covered with serous fluid containing young cells, and subsequently with glairy mucus containing pus-cells and triple phosphates. The epithelium of the follicles of Lieberkühn is granular and proliferated. The solitary glands and Peyer's patches are swollen, and occasionally the mesenteric glands are hyperæmic and enlarged.

Terminations.—Enteritis may end in resolution. It may become chronic or pass on to ulceration, sloughing, or gangrene.

Forms.—1. *Catarrhal* or muco-enteritis is the name given to that form where the mucous membrane alone is affected. 2. *Phlegmonous* enteritis is a condition in which inflammation affects all the coats, and is attended with suppuration. 3. *Diphtheritic* enteritis is due to a specific cause, and the inflammation leads to a membranous exudation. 4. *Dysenteric* is a term applied to that form of enteritis due to the specific poison of dysentery.

Symptoms.—These vary in different cases, according to the morbid changes in the tissue involved. When different portions are affected the symptoms are often dissimilar, even though the pathological changes may be alike in both cases. The disease may be mild in one person and in another it may prove fatal.

Acute catarrh often begins with restlessness or uneasiness, loss of appetite, great thirst, diarrhœa, pain about the umbilicus, sometimes vomiting, and febrile phenomena. Diarrhœa is the most

Diagnosis. — This is sometimes extremely difficult, both as regards the seat and the presence of cancer. Difficulty in the diagnosis arises from the insidious nature of the symptoms. The progressive character of the disease, the cachexia, and its resistance to treatment, point, however, to cancer. In the later stage, when no tumour can be detected, it is often mistaken for chronic enteritis. Many of the symptoms resemble those of diseases of the suprarenal capsules, but there is no discolouration of the skin. A cancerous tumour of the bowels may be mistaken for one connected with the liver, pancreas, mesentery, kidney, or uterus, or even for fæcal accumulation, or an aneurysm. In intestinal cancer, the history, age, progressive emaciation, signs of obstruction, and the character of the evacuations are the points which determine the diagnosis.

Treatment.—The treatment is only palliative. The diet should be liquid, nutritious, and such as can readily be digested by the stomach. Broths, eggs, and milk are required. The symptoms dependent upon obstruction may be relieved by laxatives. If bleeding occurs it may be checked by astringents. Pain may be relieved by morphia hypodermically injected. Colotomy may be performed if there is cancer in the rectum or sigmoid flexure.

HÆMORRHOIDS.

Hæmorrhoids are of two main kinds, external and internal, the former being the more common, and presenting two varieties. The first variety of external hæmorrhoids consists of hypertrophies or excrescences of the skin; the second, of sanguineous, venous tumours.

Causes.—These are of various kinds, the chief of them being obstruction of the liver or portal system, fæcal accumulation, or anything interfering with the free return of blood from the rectal veins. The anatomical peculiarities of the structure of the part predispose to venous enlargements. Among other causes may be mentioned excesses in eating and drinking, sedentary occupations, uterine displacements, straining, however induced, and neglect of proper ablutions.

Symptoms.—External hæmorrhoids in an uninflamed state are scarcely noticed by the patient. They appear as small pendulous flaps of skin, or as little tumours resembling varicose veins. In an inflamed state these are much increased in size, œdematous, and very painful; the venous hæmorrhoids form distinct globular tumours. They give rise to a constant sense of throbbing and to spasm of the sphincter and levator ani muscles. The patient can neither sit down nor walk without pain, and the symptoms are much aggravated when the bowels are moved. In persons predisposed to these affections, the symptoms are often brought on by some indiscretion in eating or drinking.

Internal hæmorrhoids constitute a much more serious class of disorders. They arise from all the causes already mentioned, and present several differences in appearance, structure, size, and position. They may be so small as to cause little, if any, projection into the bowel, or they may be large, solid tumours, the size of a fowl's egg. Some varieties bleed freely, the blood being either arterial or venous in character; in others this symptom is absent. Some hæmorrhoids always remain above the internal sphincter; others are protruded on straining and during exertion; others, again, always project externally. As regards their structure and appearance, three broadly-marked kinds may be observed; viz. the capillary hæmorrhoid, the arterial hæmorrhoid, and the venous hæmorrhoid. Each of these may exist alone or may be united with one or both of the others. In the first kind, the symptoms are principally due to the frequent losses of arterial blood; the piles rarely protrude, and they cause no pain unless ulceration be present. In the second and third varieties, the symptoms are due to the condition of the tumour as regards inflammation or ulceration. The piles often protrude on exertion, and are sometimes very difficult to replace; there is a constant sense of discomfort in the rectum, which is much aggravated by straining. When inflammation takes place all the symptoms become very distressing.

Treatment.—The cause must be discovered and dealt with as far as possible. All excesses should be forbidden, and rest is generally indicated. For inflamed external hæmorrhoids the parts should be well washed, and afterwards some calomel ointment or a lotion of subacetate of lead should be applied. The bowels should be kept open by mild laxatives, as citrate of magnesia, compound liquorice powder, or Friedrichshall water. Operative treatment is often required, and is always attended with good results. With regard to internal hæmorrhoids, these generally require a surgical operation, but much good may often be done by attending to the general health, and by a course of saline purgatives. For the small vascular piles strong carbolic acid is a good application, and a suppository containing from three to five grains of the subsulphate of iron will often relieve all the symptoms, and especially the hæmorrhage. For the second and third varieties operations are for the most part necessary, but constitutional treatment should never be neglected. When congestion of the liver exists a prolonged course of the Fried-

and to these small doses of opium should be added. Nausea and vomiting may be relieved by bismuth, with bicarbonate of potash and citric acid. Leeches applied to the anus may be useful to relieve hyperæmia of the intestinal tract. If the health be bad, and if the diarrhœa persists, ulceration of the bowel is likely to follow. For such cases nitrate of silver, oxide of silver, or even sulphate of copper are useful. When the rectum is especially affected injections of half a drachm of nitrate of silver in two pints of lukewarm water are generally beneficial. A powder composed of ten grains of carbonate of bismuth with five grains of Dover's powder given every four or six hours will relieve the symptoms. Various vegetable astringents are often used for the same purpose. If pain be a prominent symptom the dose of opium must be increased. During convalescence, vegetable bitters, as quassia or calumba may be given with bismuth. By way of prophylaxis such articles of food as may cause the recurrence of enteritis should be forbidden. The patient should wear flannel and avoid exposure to cold and damp. In the weak and debilitated as well as in scrofulous children there is a tendency to collapse, and stimulants should be given from time to time. In children suffering from severe enteritis, life can be preserved only by the judicious use of stimulants. Certain mercurial preparations are also very valuable in these cases. Four or five minims of the solution of the perchloride given every two hours will often cause a great change in the intestinal symptoms and in the character of the discharges. Warmth is also salutary, and warm baths may be given from time to time, their effects being closely watched.

CHRONIC ENTERITIS.

Chronic inflammation of the bowels occurs when the acute disease progresses for some time, or the original cause persists, or when the pathological changes resulting from the acute inflammation become permanent. Other causes are: obstruction of circulation in the liver, and disease of the right side of the heart causing obstruction of circulation in the veins. Chronic enteritis may be secondary to general morbid states as in Bright's disease. In such cases the circulation of a deteriorated blood leads to chronic inflammation. Chronic enteritis is often due to exposure to heat and moisture.

Post-mortem appearances.—The intestine is generally thickened and contracted; the mucous membrane is brown or grey or almost black. It may, particularly in the rectum, present polypoid growths. The epithelial cells are cloudy. The mucous and submucous layers are infiltrated with round cells and connective-tissue elements. The enlarged lymphoid follicles project as white hard nodules, and the membrane is covered with tough, grey or puriform mucus. The intestinal glands are enlarged, soft, and of a pinkish colour. In chronic colitis the exuded mucus often forms casts of the tube, and these are sometimes evacuated. There is more or less hypertrophy of the muscular coat owing to the connective-tissue formation; ulcerations are common. In children chronic enteritis is associated with atrophy of all the coats and of the glands, and ulceration does not often occur.

Symptoms.—The disease is characterised by emaciation and debility, and is accompanied either by constipation or diarrhœa. There is little or no fever. In affections of the small intestine, diarrhœa may be wanting and there may be constipation. This is owing to the diminished peristalsis, due to œdema of the muscular coat and impaired irritability. The catarrh often leads to ulcerations, and when these exist in the colon or rectum diarrhœa invariably occurs. Solid and liquid evacuations frequently alternate. The tongue is moist and furred or red and dry. The abdomen is distended with flatus. The convolutions of the intestines are readily seen and felt. The duration varies from many months to even years. There is general impairment of nutrition inasmuch as the elaboration and absorption of the digested products are interfered with. In children the marasmus is most marked. In advanced cases the mental faculties are generally affected. The patients become dull and sluggish, and often hypochondriacal. A short dry cough is a frequent accompaniment. The disease generally ends in death from inanition after a very protracted illness.

Diagnosis.—The disease is sometimes mistaken for phthisis. In diarrhœa due to tubercles there is the history of tuberculosis and the presence of tubercles in other parts.

Treatment.—The debilitating character of the disease demands roborant treatment. The patient should be fed on light nutritious diet, the food being given in small quantities and at short intervals. When fæces collect in the colon, enemata of tepid water should be regularly employed. Where the disease is due to obstructive diseases of the kidneys, heart, or lungs, these conditions should be relieved as far as possible. In the majority of cases, tonics, especially the vegetable bitters, will relieve the symptoms. Fresh air, rest, and residence in a dry and moderately warm climate are certain to be beneficial.

through the bowels is extremely small, and the dejections consist of undigested food mixed with various secretions. When abscesses or hydatid tumours in the liver open into the bowels the stools are white and contain pus or hydatids.

Diarrhœa is often associated with pain in the abdomen. In some cases the stools are passed without any uneasiness. In others, the pain is very severe. If the pain be high up and in the small intestine, vomiting is associated with the diarrhœa, but if confined to the lower part and in the large intestine, cramps in the abdomen are common. There is sometimes violent burning pain in the rectum. The pain varies in character from a mere aching to a severe griping; it is often intermittent and attended with rumbling of the bowels. It is chiefly confined to the umbilicus, but may extend over the whole abdomen; it is relieved by pressure. In some cases the abdomen is tense and puffy, in others retracted. The tongue is generally foul and furred, and sometimes red at the tip and edges; there is great thirst. The appetite is impaired. Diarrhœa is often attended with cramps in the calves and coldness of the limbs. In children diarrhœa is often associated with aphthæ.

Varieties: *Congestive diarrhœa.*—It generally results from mechanical obstruction to the flow of blood from the portal vein. In such cases draining of serum into the bowels takes place. The dejections vary: they may be thin and feculent, as if fæces were mixed with serous transudation, or consist almost entirely of watery fluid.

Inflammatory diarrhœa, otherwise known as serous diarrhœa.—It is due to irritation which excites inflammation of the mucous membrane of the bowels. The contents of the bowels are mucous or serous fluid, with shreds of fibrine or even pus. The disease often extends to the large bowel, and the stools become more frequent, scanty, and may contain streaks of blood. Such a complication is attended with violent straining.

Irritative or feculent diarrhœa.—In this variety the diarrhœa is a simple flux and is often due to the presence of irritating substances in the intestines. It occurs in children during dentition, and is the most common form of diarrhœa. In the case of children the stools are like pale clay, and contain masses of undigested casein. The evacuations soon become greenish from contact with acid urine. In other cases the stools are greenish when passed and are also acid, thus irritating the anus and the genitals. If this kind of diarrhœa be not soon checked it passes into a chronic form, or into inflammatory diarrhœa or dysentery.

Vicarious diarrhœa.—It occurs in cases where the functions of the lungs, kidneys or skin are interfered with or suppressed.

Thus, this form of diarrhœa is salutary. It sometimes occurs in gouty cases, and if the diarrhœa be checked gout is apt to advance and the health suffers. This form is often due to exposure to cold and to suppressed perspiration.

Mucous diarrhœa.—This form is seen in enteritis and dysentery. The stools at first consist of thin or thick mucus and serous fluid. In some cases the dejections are scanty, yellowish green, and are passed with straining. Where the dejections consist wholly of mucus the disease is confined to the colon, but if the motions are solid, with a coating of mucus, they show that the rectum is involved. If the dejections appear ropy and viscid the mucus is derived from the small intestine.

Bilious diarrhœa.—This is a very common variety. It is due to acrid or increased secretion of bile. Patients suffering from fever and those who are intemperate in eating and drinking are mostly affected. The stools are green or yellowish, owing to their admixture with a large quantity of altered bile.

Nervous diarrhœa.—Irritation of the sympathetic nerve increases the activity of the glands of the alimentary canal, and also the peristaltic action of the small intestine, and thus causes diarrhœa. Mental worry or anxiety may give rise to acute as well as to chronic diarrhœa. The intestinal nerve-centre often becomes so sensitive that every meal may induce an immediate call to stool. The attacks of this kind which occur in delicate children are known as *diarrhœa lienterica.*

Diarrhœa lienterica.—It is a common affection in infants during teething and weaning, also in children suffering from tabes mesenterica. The increased peristaltic movements may be the consequence of previous inflammatory irritation of the mucous surface, or of the propagation upwards of some irritation from the rectum. Undigested products entering the duodenum set up irritation and increase peristaltic action. In adults it is due to indigestion. The food passes through the alimentary canal, and appears in the dejections almost unchanged.

Choleraic diarrhœa.—This important form will be described at length in a subsequent chapter.

Ulcerative diarrhœa.—The dejections are thin, watery, muco-puriform, and often streaked with blood; they sometimes contain shreds of albuminous matter. When the ulcers are seated in the small intestines or in the cæcum the evacuations are thin, watery, and mixed with fæces; if in the large intestines the stools are muco-puriform. In some cases the discharges are dark, watery, grumous, and fœtid. In this affection the emaciation is extreme. The skin is harsh and dry; the pulse quick, small, and weak; there are often aphthæ on the lips and tongue, and hectic with exhaustion sets in.

Fatty diarrhœa.—In many cases of indigestion free fat or oil appears in large quantities in the dejections. This generally occurs when the bile and pancreatic secretion fail to reach the intestinal canal. Opium has a marked effect in producing fatty stools. The evacuations are usually liquid and highly fœtid.

Terminations.—In slight cases recovery follows. Where diarrhœa is profuse, and lasts for many days or weeks, the patient emaciates, and may die from exhaustion. Sometimes it terminates in dysentery or enteritis. In children it may give rise to convulsions. It often merges into a chronic form, both in children and adults. This change occurs either when the diarrhœa has lasted for some time, or when it is kept up by improper food, exposure to chills, &c. In India a form of chronic diarrhœa is known as *white flux*. Other forms are due to tubercles in the intestines and to liver disease. The affection is characterised by progressive emaciation and great exhaustion. The abdomen is tense, puffy, and often tender. The tongue is generally furred and moist. There is constant rumbling in the abdomen, some loss of appetite, but no nausea. The evacuations in "white flux" consist of soft, white material, passed with much straining. There is a constant feeling of discomfort in the lower part of the rectum, and often pain in the bowels generally. This complaint, as it occurs in the hill stations in India, often subsides spontaneously if the patient is kept warm and in bed, but recurs on exposure. Relapses are common.

Diagnosis.—Diarrhœa may be mistaken for epidemic cholera, dysentery, and mucous irritation of the bowels from retention of fæces. The presence of bile in the evacuations excludes cholera. In this latter there is absence of the ordinary causes of diarrhœa, the stools are colourless and like rice-water, and there is suppression of urine and early collapse. The vomited matter is merely a colourless fluid, and not bile or undigested food, as in diarrhœa. With regard to dysentery, frequent calls to stool, scanty evacuations of mucus and blood, passed with severe straining, exclude diarrhœa. The dysenteric evacuations are, however, at first thin, watery, and fæculent. In diarrhœa there is no tenesmus, no marked pain or tenderness in the regions of the cæcum or sigmoid flexure. In mucous irritation of the bowels there is retention of fæces, as can be felt by a finger in the rectum. There are frequent thin, watery, muco-fæculent, or only mucous stools, passed with straining.

Treatment of diarrhœa generally.—The treatment must be shaped according to the nature of the cause. If due to irritating contents, diarrhœa is due to the presence of ulcers, the pain can be best relieved by the subcutaneous injection of morphia, $\frac{1}{8}$th and atropine $\frac{1}{100}$th of a grain; opium or morphia suppositories are also useful. If there is great tenesmus, oxide of zinc in two- or three-grain-doses may be prescribed. For the relief of pain and tenderness, various balsams and the decoction of logwood with nitro-muriatic acid and opium are to be depended upon. Various mineral astringents may be given with advantage. The natives of India give myrobalan freely in these cases with decidedly good effects.

To restore or to rouse the digestive and assimilative functions, tonics as iron, quinine, arsenic, strychnia, and the mineral acids are the best remedies. In cases of chronic diarrhœa a flannel bandage worn round the abdomen may be especially recommended; a dry and bracing locality should be selected.

DYSENTERY.

The word *dysentery* literally means difficulty of the intestines. It is a specific febrile disease very prevalent in tropical climates, where it is endemic, or almost epidemic, and characterised by considerable nervous prostration and by inflammation of the solitary glands and follicles of the large intestine, accompanied by tormina, followed by straining and frequent mucous and bloody evacuations. The morbid changes rarely involve the deeper layers of the affected canal and seldom extend into the ileum; they generally end in resolution. In severe cases the glands ulcerate, or the whole bowel may become disorganised into shreds or sloughs; occasionally the process ends in gangrene. Perforation is rare.

Causes.—The disease is most frequent in the neighbourhood of swamps and marshy places, where miasmatic fevers are most prevalent. In paroxysmal fevers there is more or less congestion of the liver, spleen, and the whole of the portal system, and gastric and intestinal digestion is seriously interfered with. The gastric, pancreatic, hepatic, and the various intestinal secretions are altered both in quantity and quality owing to the congestion. Diseases of the liver are frequent accompaniments of dysentery. In many cases hepatic disorders precede and share in the production of the attack. The poison, whatever be its nature, affects especially the solitary glands of the large intestine; the structures of the small intestine are for the most part uninvaded. Dysentery occurs at all ages and in both sexes. In India it is most prevalent during the months of August, September, October, and November. Dysentery may be acute, or chronic, and the acute form may be due to a variety of causes. These are—1. Vicissitudes of climate and great ranges of temperature such as tropical heat by day, followed by the cold and dews of night. Persons sleeping on the ground in marshy districts are very liable to an attack. 2. Other causes are peculiar contamination of the air by foul and miasmatic effluvia, or exhalations from marshy soils after the rains. 3. A debilitated state of the constitution predisposes to dysentery. 4. Unwholesome drinking water is a very frequent cause. 5. Other causes act by irritating directly the mucous membrane of the large intestine. It is thus that alcoholic liquors, irritating purgatives, unwholesome or putrid food, sour beverages, raw fruits, &c., may induce an attack of the disease. Their ill-effects are often witnessed in persons already suffering from the disease. The effect of chills has been already mentioned; it is much heightened when moisture is superadded. Suppression of the cutaneous secretion augments the intestinal congestion.

In cases in which there is primary hepatic derangement the acrid or vitiated bile and other secretions set up irritation, which may become a starting-point for dysentery. The disease is sometimes a complication of scurvy, and is then known as scorbutic dysentery.

Pathology.—Some consider dysentery as a simple inflammation; others regard it as due to a specific poison which is contained in the excreta, and often finds its way into drinking water. It is certain that water thus contaminated can propagate the disease. That it is a contagious disease is opposed to the views of most authors. Besides being contained in water, the poison from the excreta may be communicable through air or food. Overcrowding and want of ventilation would appear to be accessory causes of great importance.

Morbid appearances.—These may be divided into four stages: First degree of severity (congestive stage). The solitary glands are congested, and their vessels engorged with blood. Here and there we find peritoneal adhesions, with effusion of lymph or of serum; the mucous membrane of the large intestine is reddened, dry, and glistening. It is infiltrated with greyish-white exudation, which covers the epithelial coating; the glands form round prominences on the mucous membrane, varying from the size of a millet-seed to that of small shot. The mucous membrane surrounding the glands is usually rough and covered with a thin aphthous layer, and with particles of epithelium mixed with fibrine. Other viscera are often affected. The liver is hyperæmic, and the gall-bladder contains dark-coloured, concentrated bile. Even in this stage the mucous membrane sometimes exhibits excoriations, with detachment of the epithelium.

intestines are frequently met with in children as a part of general tuberculosis. In adults the affection is generally associated with phthisis and is secondary to it.

Morbid appearances. — The tubercles at first invade the submucous tissues and the peritoneal coat, the ileum and the cæcum being the parts especially affected. In the duodenum and jejunum they are very rare. In the stomach they are never found. In scrofulous children, who die of acute tuberculosis, numerous grey granulations are found in the solitary and agminated glands and in the submucous tissue. In advanced cases the granulations form masses, which undergo cheesy metamorphosis and break down, giving rise to tubercular ulcers. Such ulcers are characteristic. They readily spread, but seldom heal, and they invade the intestine in a direction round the bowel. Incomplete cicatrization is often found. The extension of a tubercular ulcer is preceded by a development of fresh tubercles, which pursue a similar course. The union of several ulcers may cause great loss of substance both superficially and deeply. Perforation is rare, inasmuch as adhesions are generally formed. The edges of the ulcers are irregular and thickened and are studded with miliary tubercles.

Symptoms.—In the early stages in strumous children it may be difficult to decide whether the case is one of intestinal catarrh or cheesy metamorphosis and ulceration. The case is suspicious if the passages be preceded by pain, the abdomen is sensitive to pressure, the fever lingering, and there is diarrhœa. Sometimes diarrhœa disappears for a time, but there are soon again frequent copious fluid stools. Tuberculosis may last for years; the thinness of the motion depends upon the catarrh, which varies in intensity. The symptoms are those of ulceration of the bowels in general. When the tubercles are limited to the ileum there will be pain, tenderness, and griping in the iliac fossa, and the bowels may be irregular. If the large intestines are diseased the symptoms will be those of dysentery. Tuberculosis of the intestines is a progressive disease, and therefore the diarrhœa is intractable; the patient rapidly loses flesh and strength, and in advanced cases suffers from night sweats and cold extremities; there are also symptoms of tubercles in other organs. Hæmorrhage occasionally takes place, and death most often results from lung disease.

Treatment.—Very little can be done with a hope of cure in these cases. Owing to the presence of tubercles in the intestines, the digesting and absorbing surface is considerably lessened, and the food is not assimilated unless it be of a nature to be easily digested in the stomach. Opiate enemata often check the diarrhœa, but the effect is temporary. Hæmorrhage often sets in and can be partially checked by acetate of lead and opium. The general treatment of tuberculosis must of course be adopted.

DISEASES OF THE MESENTERIC GLANDS.

The mesenteric are the lacteal glands which lie in the fold of the peritoneum connected with the intestines. In disease of these glands the general nutrition suffers, owing to the interference with the due transmission of chyle. Where the disease extends the neighbouring tissues, and chiefly the peritoneum, become involved, and peritonitis is apt to occur as a result of irritation or rupture. The pressure of these glands upon the portal system of veins may lead to ascites.

Acute congestion and inflammation of the mesenteric glands often occur as a result of diseases affecting the intestinal canal. The seat and number of inflamed glands vary with the portion of the bowel affected. Enlargement is seldom followed by suppuration, and usually subsides. In some cases, however, the glands shrivel up, become tough and contracted and even calcify. Typhoid fever and dysentery are the two chief diseases in which the mesenteric complication occurs.

Tubercular or scrofulous disease of the mesenteric glands. The affection is otherwise known as *tabes mesenterica.* It is a most important disease, and generally affects persons who present characteristics of the scrofulous diathesis. It is common in children and young persons. The changes in the glands may originate in irritation or ulceration of the bowels, or may occur spontaneously. When one gland becomes affected others in connection with it or at a distance become afterwards implicated. The disease is often secondary to tubercular ulceration of the intestines.

Morbid changes.—The changes in the glands generally run a chronic course. There is at first hyperplasia of the gland elements, and the glands become enlarged and firm. Owing to low vitality, if the disease lasts long, the glands become caseous and degenerate or disintegrate. When caseation takes place the gland becomes yellow and soft, and chronic abscesses may form. When the glands calcify they remain as inert, chalky masses.

Symptoms.—The disease being often secondary to intestinal ulceration and catarrh the symptoms are such as have been already described in the accounts of these affections. Those most characteristic are—1. Disordered digestion. 2. Enteric catarrh and diarrhœa recurring on the least provocation, and difficult to check. 3. The abdomen is distended and often tympanitic. 4. The enlarged glands may sometimes be felt on palpation, and by deep pressure

over the abdomen; they often set up peritonitis as a result of irritation. In every case marasmus is a characteristic symptom. The patient becomes anæmic and suffers from hectic. Death from asthenia is the common result, but when the glands become calcareous recovery follows.

Treatment.—That of the scrofulous diathesis should be adopted. The patient should have cod-liver oil, pancreatic emulsion, preparations of iron, quinine and other tonics. Change of air, sea bathing, and exercise in the open air will be very serviceable. Attention must be paid to the diet. It should be nutritious, easily digestible by the stomach, and taken in small quantities and repeatedly. Any urgent symptoms will require relief. Diarrhœa should be checked by enemata of starch and opium, or of acetate of lead and opium. The other abdominal symptoms may be relieved by fomentations or poultices, or by a flannel bandage.

ALBUMINOID DISEASE OF THE INTESTINES.

It is a degenerative disease occurring when the same affection has far advanced in other organs, as the spleen, liver, kidneys, and lymphatic glands.

Morbid appearances.—The inner coat of the intestinal arteries, and especially of those surrounding the solitary and agminated glands, undergoes albumenoid change. The glands for a long time resist the degenerative change, but ultimately become involved. The mesenteric lymphatic glands are also affected. All the coats of the bowels are replaced by this new material. The mucous membrane appears tough, pale, and thick, and in extreme cases ulcers form. The ileum is the favourite seat of this disease.

Symptoms.—The chief of these are diarrhœa and hæmorrhage. Other symptoms refer to the complications. The diarrhœa is persistent, and the evacuations are generally fluid, and often greenish from altered blood. There is no pain or tenderness. Hæmorrhage frequently occurs.

Treatment.—This is only palliative. Enemata of starch with opium often give relief.

DISEASES OF THE COLON.

Lesions of the colon are sometimes connected with dysentery, typhoid fever, enteritis, and peritonitis. A common affection of the colon is known as ***atony***, which is due to loss of contractile power of its muscular coat. Inflammation, otherwise known as ***colitis***, is a local non-specific lesion attacking the submucous and

mucous coats. Displacements of the transverse portion and of the sigmoid flexure are sometimes met with. Diverticula loaded with fæces sometimes form distinct tumours.

Atony.—In this condition there is diminished contractile power of the muscular coat. As a result there is retention of fæces and gases, and constipation.

The *causes* of atony are the same as those of constipation. When once the condition is established, the loss of contractile power increases. Paralysis of the sympathetic nerve is a cause of tympanitic distension of the abdomen as occurs in peritonitis and typhus.

Symptoms.—The flatulent distension and large fæcal accumulations impede the descent of the diaphragm and thus lead to dyspnœa, palpitation, &c. The disturbed circulation in the brain gives rise to giddiness and headache. The distended colon pressing on the veins may cause numbness and cramps in the lower limbs. The digestion becomes deranged and the liver is also disordered. The general symptoms are due to the absorption of excrementitious materials. These are sallow, earthy complexion, lassitude, offensive breath, and loaded urine.

Treatment. — Constipation being the chief factor in causing atony, it should be remedied by hygienic and dietetic measures and also by medicine. The principal drugs to be relied on are tonics as iron, quinine, and strychnia combined with aperients as aloes, colocynth, and podophyllin. Belladonna may be added with advantage. Locally the measures already recommended for the treatment of constipation may be employed. The flatulent distension so common in females is best relieved by compound assafœtida pills and nux vomica.

Colitis.—The disease is often mistaken for dysentery. Up to a certain point the lesions are the same in both affections. In colitis the inflammation is non-specific and commences in the submucous tissue and then extends to the mucous membrane and the gland structures. In dysentery, the inflammation begins in the glands and is specific in character.

The catarrhal form of colitis sometimes accompanies measles. It is characterised by glairy bloody stools and tenesmus. Colitis often results from retained excreta in a limited portion of the colon, and from extension of typhlitis. In fæcal retention, the mucous follicles of the colon become obstructed and colitis may result.

Treatment.—The inflammation can be subdued by fomentations or poultices; the pain may be relieved by opiate enemata or by morphia suppositories. Feculent retention may be treated with

castor-oil and opium. In the ulcerative stage the injection of a solution of nitrate of silver, gr. j to ℥j of water, is the best remedy.

DISEASES OF THE CÆCUM.

The morbid conditions connected with the cæcum are accumulation of fæces, and inflammation of the walls, otherwise known as *typhlitis*. Where the inflammation extends into the cellular tissue behind the cæcum the disease is known as *perityphlitis*.

Accumulations.—Hardened fæces, worms, intestinal concretions, and gases resulting from decomposition not unfrequently collect in the cæcum and set up various disturbances. In such cases the right iliac region is full and hard, the tumour is well defined and feels doughy to the touch; it is painless and resembles in shape the form of the cæcum. The accumulation may end in more or less complete obstruction of the bowels, and it sometimes causes peritonitis. Numbness and œdema of the right leg and retraction of the right testicle are also observed. In a few cases typhlitis results.

Typhlitis.—In this disease the inflammation affects the muscular and mucous coats of the cæcum. Typhlitis is liable to end in perforative ulceration, peritonitis, and in perityphlitis.

Causes.—The anatomical peculiarity of the cæcum predisposes it to fæcal or other accumulations; the retention of fæces or foreign bodies for a long time gives rise to inertia of the large intestine. The exciting causes are exposure to cold and ingestion of various irritating articles.

Morbid anatomy. — Perforation of the cæcum, or vermiform appendix, more or less diffused peritonitis, adhesions, and in some cases, abscesses are the principal changes observed in fatal cases. The inflammation may be either propagated from other parts or may be limited to the cæcum. In the catarrhal form, the exudation becomes absorbed and recovery results. In other cases the inflammation is more severe; the exudation sometimes leads to diffuse necrosis of the connective tissue and ulceration or abscesses result, and give rise to perforation.

Symptoms.—These are pain and tenderness in the right iliac fossa, generally associated with rigors and fever. There is usually some previous history of intestinal derangements. The pain is continuous, increasing on pressure and on movement, as by deep inspiration and coughing. Owing to extreme tenderness, the patient lies on the right side and the knees are drawn up. There is fulness and hardness in the cæcal region. Where typhlitis is due to fæcal accumulation there is a defined tumour occupying the ducts, or even of the serous covering. Where the ulcers are the results of a molecular death of the tissue, sloughs do not form, but in the weak and cachectic the ulceration is often preceded by the formation of large sloughs, which may involve the muscular coat, and may even be associated with gangrene. These sloughs are found in different conditions. They may be partly detached or firmly adherent, compact or shreddy, flocculent or stringy, and greyish-green or yellow in colour. When gangrene occurs the mucous and muscular coats are thickened and of a black colour. The gangrenous lesions are generally restricted to the ascending colon, cæcum, and sigmoid flexure, but sometimes the whole of the large intestine is thus affected.

Dysenteric ulcers may remain open for months or years, and repair is always a slow process. They may terminate in perfect cicatrisation or repair by granulation, with or without puckering. Where the ulcers are large the cicatrices are thick, indurated, and contracted, and strictures result, and cause more or less obstruction in the bowel. Besides the lesions in the large intestines, other morbid appearances are often found. These are (1) redness and roughening of the mucous membrane of the ileum; (2) the absorbent glands connected with the colon, and the mesenteric glands are inflamed and enlarged; (3) the spleen is often enlarged; (4) abscess of the liver is not an unfrequent phenomenon; (5) in chronic cases phthisical lesions are sometimes superadded.

Symptoms.—These are (1) febrile phenomena; (2) those due to excessive irritation and spasmodic contractions of the large bowels; (3) those due to constant outpourings into the bowels from the diseased mucous membrane. The sthenic form presents various grades of severity depending upon the nature of the cause, the state of the secretions, and the degree of irritation of the bowels.

Dysentery is generally preceded by symptoms of indigestion, with more or less constitutional disturbance. In one variety there is great thirst and loss of appetite. The tongue is furred and less moist than natural. The eyes are glistening. There is some heat of skin, occasional chilliness, and diminution of strength. The temperature rises towards evening. There is pain over the abdomen; the bowels are constipated or somewhat loose. All these symptoms indicate commencing inflammation of the solitary glands. In the second variety the disease commences with simple diarrhœa with slight colicky pains, and sometimes a feeling of soreness in the left iliac region. The patient feels weak, and has no inclination for food. The tongue is furred; there is clamminess of the mouth and great thirst. As the case advances, or after two or three days, there is marked [illegible]. The bowels now are more they increase the inflammation and, by setting up further irritation, may lead to perforation. The diet should be liquid, given in small quantities and repeatedly.

DISEASES OF THE RECTUM.

Diseases of the rectum form a numerous class, but the lesions are mostly seated within two inches of the anus. The principal diseases are for the most part of a surgical nature, and require only a passing notice.

Fistula in ano.—The most common cause of this affection is the formation of an abscess in the loose areolar tissue round the lower part of the anus. The abscess bursts, leaving a fistula, which is indicated externally by a button-like growth with a central opening. When a sinus exists communicating with the external integument and with the rectum, the fistula is described as complete; when there is no external opening, the case is one of blind internal fistula. The abscess often burrows, and may extend in the direction of the buttock or the perineum. Fistula also results from a phlegmonous abscess, and from an ulcer within the external sphincter. In cases of tubercular ulceration, as occurs in phthisis, the opening is often found very high up in the bowel. The treatment of fistula falls within the province of the surgeon.

Malignant diseases of the rectum.—The rectum is sometimes the seat of cancer and sarcomatous growths, which more or less block up the passage. They are liable to spread and to invade adjoining parts. They are generally found in the lower part of the bowel, within three inches of the anus. The disease is more common in men than in women, and after middle life.

Symptoms.—These are similar to those of stricture of the rectum. The whole of the diseased gut becomes thick, contracted, and indurated. The patient has difficulty in passing stools, and suffers from flatulence and pain about the sacrum, extending down the thighs. The motions are generally loose, thin, serous, and frequent, and contain blood, and are passed with scalding. The destruction of the sphincter and of the nerves supplying the muscle leads to involuntary discharge of fæces. The patient gradually loses flesh and strength, and sometimes complete obstruction occurs, ending fatally. Death is generally due to exhaustion.

Treatment.—This is only palliative. The pain must be relieved
tives, and especially by morphia subcutaneously injected, or
rm of a suppository. Excision of a portion of the bowel
tomy are sometimes performed in these cases.

ture of the rectum.—The stricture may be limited in extent, reduced to a skeleton. Pain is no longer felt owing to the loss of sensibility. The sudden fall of temperature with the cessation of pain is a bad symptom. The dejections are dark, watery, and highly fœtid, and contain sloughs and exudation looking like washings of beef. Sometimes, muscular fibres may be discovered in the dejecta. The colon is felt to be swollen and thickened. The stools are passed involuntarily in bed. Hiccough comes on, the sphincters are relaxed; exhaustion is sometimes increased by hæmorrhage from the bowels. The patient eventually dies. In some cases perforation and peritonitis precede death. In favorable cases, the local and general symptoms become milder, the tormina and tenesmus are less severe; the dejections, which consisted of sloughs, mucus, and blood, now improve, and a little thin fæculent matter begins to appear in the stools. The patient feels relief from his painful symptoms, the appetite returns, the tongue becomes clean, and the strength improves. The pulse increases in volume and becomes less frequent. In a small proportion of cases the sloughing passes into gangrene, and large portions of the mucous membrane, and of the muscular coat are affected. Such cases are attended with extreme prostration and collapse. The pain, which before gangrene set in was excruciating, now altogether disappears. The stools consist of watery products of a dark colour, and have a highly offensive and gangrenous odour. The abdomen now becomes tympanitic and free from tenderness. The face is haggard, the skin is cold and clammy, the tongue is dry, furred, and brown; the pulse is thready and irregular; there are involuntary passages of urine and fæces, and the patient dies exhausted, generally before the end of the second week.

Dysentery often exhibits various modifications. Thus, in some epidemics, the patient is suddenly attacked with fever, and the bowels being constipated, he takes a dose of some purgative medicine. After this has acted upon the bowels the dysenteric symptoms follow. In other cases the dysenteric symptoms are observed from the very first, and are referred to the colon, cæcum, or rectum. When confined to the rectum the patient is compelled to remain long at stool; he passes a little mucus and very little fæculent matter. The stools are frequent, very offensive, but there is only slight uneasiness in the abdomen. There is often a burning sensation at the anus; after an evacuation relief is obtained, but in a few minutes pain returns, and is more agonising than before, and the patient has to go to stool perhaps twenty or thirty times in twenty-four hours. When the dysenteric lesions are seated in the cæcum or colon, there is much less tenesmus, but there is primary fever. Another modification is shown by cases which commence with diarrhœa or other [illegible] in the abdomen. This is followed by dysenteric stools, burning pain at the anus, as if a foreign body were lodged there, also pain and tenderness in the course of the large intestine. At first the abdomen is retracted on account of the pain, but it soon becomes distended owing to collection of gases in the intestines.

In dysentery the matters discharged from the bowels exhibit great variations as regards quantity and quality. The quantity of bloody mucus discharged is a rough indication of the extent of the mucous membrane affected. In severe cases the calls to stool vary from forty to fifty in twenty-four hours, and nothing but mucus or blood is passed. In some cases the discharge is semi-fæculent and consists of broken down hard fæces mixed with slime. In other cases the discharge is gelatinous and mixed with blood, and contains little or no fæculent matter. When the taking of food causes an immediate evacuation with some fæces in the stools, the higher part of the large intestine is affected. In such cases the stools are very fœtid, of a greenish hue, and contain abundant biliary secretions with pieces of albumen and fibrine. The blood in the dejections is dark and grumous, and mixed with the discharges. When the disease is confined to the rectum the stools at first contain hard scybala covered with mucus. The blood is fluid and in large quantity. In advanced and unfavorable cases the stools contain only sloughs and shreds of membrane mixed with mucus and blood. Under the microscope the stools present abundant epithelium-cells, blood-corpuscles, exudation, and pus-cells, and shreds of the membrane.

With regard to other symptoms, pain, tension, and fulness in the abdomen are common. When the pain is in one fixed spot, it denotes inflammation or disorganization of that part of the intestine. In dysentery the pain is chiefly complained of in the course of the colon, and in the cæcum. Where the disintegration has extended to the serous coat of the bowels, the pain and tenderness are very marked.

Dysentery is divided into various types. These are (1) inflammatory, which may be sthenic or asthenic, (2) malignant or putrid, (3) scorbutic, (4) bilious, and (5) malarial.

The *acute* is a very severe type of the disease. It is generally sporadic, but sometimes endemic, though seldom epidemic. It is characterised by the symptoms already described. When the disease is far advanced it is attended with extreme prostration, and the vascular and nervous functions are greatly depressed. These cases readily assume an asthenic type, which in another class of cases is a primary characteristic. The attack then sets in with great depression of the vital powers, and of all the functions. In addition to the other symptoms there is fever of a low adynamic type, and as the disease advances the fever assumes a hectic character. The face is pale and anxious, and there is occasional vomiting.

The *malignant* or putrid form is common among a famine-stricken population, and in soldiers during arduous campaigns in unhealthy climates. In this variety the dejections are fœtid, scanty, and bloody, or watery and dark, and are often passed involuntarily. They also contain large shreds of the mucous membrane. There is slight delirium, and symptoms of intense depression. There is often bleeding from the nose, and petechiæ appear on the body, and death takes place in a few days.

In the *scorbutic* form the disease is characterised by great hæmorrhage, which is very difficult to restrain.

Bilious dysentery.—This form is most prevalent within the tropics, where remittent fever is most common. It is endemic in India, and the weak and debilitated are most prone to its attacks. It sets in with diarrhœa, with yellow stools; the patient complains of great debility, severe pain in the head, giddiness, and fever. The appetite is lost, and there is nausea and sometimes vomiting. In the early stage the evacuations are copious, and continue so for two or three days, when they become dysenteric and of a darker colour. As the case progresses there is great restlessness, irregular, quick, and soft pulse, dry and brown tongue, and other typhoid symptoms. The affection very often merges into a chronic form.

Malarial dysentery.—In malarial and marshy places dysentery often assumes a periodic form, and is associated with more or less distinct attacks of fever.

Hepatic dysentery.—This form is common within the tropics, chiefly in persons addicted to the abuse of spirituous drinks. In it the biliary secretion is disordered and the liver is inflamed, enlarged, or otherwise altered in structure. Jaundice is a frequent complication, and the spleen, pancreas, and mesenteric glands are often affected. The disease is characterised by headache, vertigo, bilious vomiting, and green-coloured stools; there is pain in the hepatic region and in the right shoulder, and a short, dry cough. In this state abscess of the liver often supervenes, sometimes early, sometimes insidiously after a long time.

Chronic dysentery.—Like all other chronic complaints, this affection may continue for a long time, with frequent remissions and exacerbations. It often lasts for years, or even throughout life. It is generally a result of acute dysentery, and particularly of cases in which anæmia due to fatty or degenerative diseases of the liver or spleen is a prominent symptom. It also occurs in the scorbutic and strumous diatheses. The symptoms depend on the disordered

It is most often met with in the flexures of the colon, where delay occurs in the passage of the intestinal contents. It commences at a certain spot, and then invades the whole thickness of the walls. It also implicates the mesenteric and the neighbouring lymphatic glands, and extends into other parts.

The varieties of carcinoma affecting the intestine are scirrhus, medullary, encephaloid, and colloid. The colloid form begins in the peritoneum, and then extends inwards. Other growths are epithelioma, lymphadenoma, and adenoma. All these growths have a tendency to degenerate and ulcerate.

Course.—The diseased part often sinks, and is fixed by adhesions to other parts. The cancerous growth forms an irregularly-shaped mass, varying in size and consistence, and obstructing the canal of the bowel to a greater or less extent. Ulceration is a constant accompaniment. The growth sometimes spreads in an annular manner, and almost obliterates the canal. If sloughing takes place some enlargement may follow, to be succeeded by constriction at a later stage. Above the stricture the intestine is dilated, filled with fæces and gas; its wall is hypertrophied, its mucous membrane inflamed, and below the stricture the canal is collapsed.

Symptoms.—The disease cannot always be diagnosed with certainty. For some time the patient may complain of nausea and vomiting. The belly is puffed up and there is habitual constipation and signs of intestinal obstruction. In exceptional cases the bowel becomes dilated, and there is diarrhœa alternating with constipation. The stools are characteristic of stricture; the scybala have an abnormal shape and size; ultimately the patient passes much mucus and blood mixed with sloughed portions of cancer. Other characteristic signs are marked cancerous cachexia and rapid wasting. If the peritoneum is affected, peritonitis is present. Ascites is a usual complication of colloid cancer.

With regard to the local signs a tumour can sometimes be felt. This is hard, irregular, and somewhat nodular, and either moveable or fixed. There may be ill-defined fulness in one region. The growth is generally felt on the left side of the abdomen. On percussion of the abdomen the sound is tympanitic, owing to the coils of intestines intervening between the growth and the abdominal walls. Pain is often wanting; when present it may be localised and of a dull character. When the disease affects the sigmoid flexure and rectum there is very severe localised pain.

Terminations.—The disease is progressive and always ends fatally. The average duration is estimated to be eighteen months. Death may result from exhaustion, from hæmorrhage, or from peritonitis.

ducts, or even of the serous covering. Where the ulcers are the results of a molecular death of the tissue, sloughs do not form, but in the weak and cachectic the ulceration is often preceded by the formation of large sloughs, which may involve the muscular coat, and may even be associated with gangrene. These sloughs are found in different conditions. They may be partly detached or firmly adherent, compact or shreddy, flocculent or stringy, and greyish-green or yellow in colour. When gangrene occurs the mucous and muscular coats are thickened and of a black colour. The gangrenous lesions are generally restricted to the ascending colon, cæcum, and sigmoid flexure, but sometimes the whole of the large intestine is thus affected.

Dysenteric ulcers may remain open for months or years, and repair is always a slow process. They may terminate in perfect cicatrisation or repair by granulation, with or without puckering. Where the ulcers are large the cicatrices are thick, indurated, and contracted, and strictures result, and cause more or less obstruction in the bowel. Besides the lesions in the large intestines, other morbid appearances are often found. These are (1) redness and roughening of the mucous membrane of the ileum; (2) the absorbent glands connected with the colon, and the mesenteric glands are inflamed and enlarged; (3) the spleen is often enlarged; (4) abscess of the liver is not an unfrequent phenomenon; (5) in chronic cases phthisical lesions are sometimes superadded.

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Dysentery is generally preceded by symptoms of indigestion, with more or less constitutional disturbance. In one variety there is great thirst and loss of appetite. The tongue is furred and less moist than natural. The eyes are glistening. There is some heat of skin, occasional chilliness, and diminution of strength. The temperature rises towards evening. There is pain over the abdomen; the bowels are constipated or somewhat loose. All these symptoms indicate commencing inflammation of the solitary glands. In the second variety the disease commences with simple diarrhœa, with slight griping pains, and sometimes a feeling of weight in the right iliac region. The patient feels weak, and has no inclination for food. The tongue is furred, there is clamminess of the mouth and great thirst. As the case advances, after two or three days there is marked tenesmus. The bowels now act more frequently, and the stools are copious and watery, but soon become scanty and slimy, consisting of mucus, occasionally streaked with blood. During or immediately after each stool there is griping and straining, and often heat and scalding in the rectum. The griping and straining are greatest when the disease is seated in the sigmoid flexure, descending colon, and rectum. There is extreme prostration, considerable increase of temperature, with a quick, irritable pulse, and great restlessness. The sleep is greatly disturbed by frequent calls to stool. This form may terminate favorably in from two to eight days, but it very often lasts for a longer time, and the disease either becomes chronic or increases in severity, and there is sudden aggravation of the previous symptoms. The pain now becomes agonising, and there is increased straining on every call to stool. If the disease be severe in the rectum there is difficult micturition and sometimes retention. There is great exhaustion and depression of spirits. The face is pinched and anxious and the pulse frequent and weak. Tenderness of the abdomen becomes a marked symptom. The straining is so great that patients feel as if the bowels themselves would pass out. In weakly subjects prolapse is very common and frequent. The nature of the dejections corresponds with the existing morbid lesions. Sometimes they are scanty from the very first, and consist of mucus or gelatinous matter, often streaked with blood. When the colon or the rectum is affected the motions contain little or no fæculent matter, and are for the most part fluid. When the affected portion is low down in the rectum, the calls to stool are almost incessant. The patient very often passes a great portion of his time in the night-chair, and can only partially free the highly inflamed and sensitive rectum of a little mucus and blood. This variety lasts from two to eight days in the acute stage, and may, under favorable circumstances, end in recovery.

Under opposite conditions, the disease passes into a very serious stage, viz. that of ulceration. All the more distressing symptoms are much aggravated. The abdominal muscles are very tense. As the disease advances, there is increasing loss of muscular power. The stools are still more frequent and painful. Later on they are watery and of a dark muddy appearance; they may contain serum and blood, or blood alone; sometimes they contain pieces of fat or portions of exudation in masses of various sizes resembling sloughs. Under proper management the ulceration yields and repair may be effected. In unfavorable cases sloughing follows, with destruction in mass of the mucous membrane. In such cases symptoms of collapse supervene. The skin becomes cool, the tongue is dry and brown, aphthæ form about the lips and tongue, and the patient is richshall or Carlsbad waters, with a little blue pill occasionally at bedtime, will be found very useful. Equal parts of the confections of senna, sulphur, and black pepper also form a good aperient for these cases.

DIARRHŒA.

It is a disturbance of intestinal action arising from various general and local causes. In a majority of cases there is no inflammatory or structural disease of the intestinal canal, except as a secondary result. Diarrhœa signifies a flux or frequent profuse discharge of fluid evacuations from the intestines, often accompanied by pain, but without tenesmus.

Causes.—These are predisposing and exciting. The disease affects persons of all ages and of both sexes. It is much more frequent in infants, and especially during the first dentition. In persons of nervous temperament depressing emotions, such as grief or fear, sometimes induce diarrhœa. It is common in persons of weak constitution and digestion. It is often endemic, owing to miasmatic influences. It is sometimes epidemic, especially within the tropics after the rains.

Exciting causes.—All those circumstances which cause irritation of the mucous follicles, or which interfere with the secreting and absorbing functions of the intestine, may induce diarrhœa. The chief of these are improper food of all kinds, or food taken in excess. Eating unripe fruit is, perhaps, the most common cause of diarrhœa. Other causes are irritants or poisons swallowed, impure water, decomposed or imperfectly masticated food, the existence in the intestines of the products of faulty digestion and of excessive or vitiated bile, of hard scybala, of entozoa, &c. In Bright's disease the elimination of urea by the intestines leads to mucous catarrh of these organs. A similar condition to this is produced by the action of most cathartics. Diarrhœa is often occasioned by unhygienic circumstances which interfere with intestinal digestion. Thus, exposure to damp or to effluvia from drains and sewers leads to it. Residence in cold, dark, and ill-ventilated dwellings is another cause. Exposure to draughts of cold air, chills, as from wet feet, overheating, and sudden changes of temperature, cause increased secretions from the intestines. Cold drinks, taken while the body is heated, produce a similar effect. Diarrhœa is a common symptom in many diseases which are accompanied by congestion of the portal system. Of these, cirrhosis of the liver is a prominent example. Other causes are organic disease of the mucous membrane of the bowels, as tubercular, typhoid, cancerous, or simple follicular ulcerain the abdomen. This is followed by dysenteric stools, burning pain at the anus, as if a foreign body were lodged there, also pain and tenderness in the course of the large intestine. At first the abdomen is retracted on account of the pain, but it soon becomes distended owing to collection of gases in the intestines.

In dysentery the matters discharged from the bowels exhibit great variations as regards quantity and quality. The quantity of bloody mucus discharged is a rough indication of the extent of the mucous membrane affected. In severe cases the calls to stool vary from forty to fifty in twenty-four hours, and nothing but mucus or blood is passed. In some cases the discharge is semi-fæculent and consists of broken down hard fæces mixed with slime. In other cases the discharge is gelatinous and mixed with blood, and contains little or no fæculent matter. When the taking of food causes an immediate evacuation with some fæces in the stools, the higher part of the large intestine is affected. In such cases the stools are very fœtid, of a greenish hue, and contain abundant biliary secretions with pieces of albumen and fibrine. The blood in the dejections is dark and grumous, and mixed with the discharges. When the disease is confined to the rectum the stools at first contain hard scybala covered with mucus. The blood is fluid and in large quantity. In advanced and unfavorable cases the stools contain only sloughs and shreds of membrane mixed with mucus and blood. Under the microscope the stools present abundant epithelium-cells, blood-corpuscles, exudation, and pus-cells, and shreds of the membrane.

With regard to other symptoms, pain, tension, and fulness in the abdomen are common. When the pain is in one fixed spot, it denotes inflammation or disorganization of that part of the intestine. In dysentery the pain is chiefly complained of in the course of the colon, and in the cæcum. Where the disintegration has extended to the serous coat of the bowels, the pain and tenderness are very marked.

Dysentery is divided into various types. These are (1) inflammatory, which may be sthenic or asthenic, (2) malignant or putrid, (3) scorbutic, (4) bilious, and (5) malarial.

The *acute* is a very severe type of the disease. It is generally sporadic, but sometimes endemic, though seldom epidemic. It is characterised by the symptoms already described. When the disease is far advanced it is attended with extreme prostration, and the vascular and nervous functions are greatly depressed. These cases readily assume an asthenic type, which in another class of cases is a primary characteristic. The attack then sets in with great depression of the vital powers, and of all the functions. In addition to the other symptoms there is fever of a low adynamic through the bowels is extremely small, and the dejections consist of undigested food mixed with various secretions. When abscesses or hydatid tumours in the liver open into the bowels the stools are white and contain pus or hydatids.

Diarrhœa is often associated with pain in the abdomen. In some cases the stools are passed without any uneasiness. In others, the pain is very severe. If the pain be high up and in the small intestine, vomiting is associated with the diarrhœa, but if confined to the lower part and in the large intestine, cramps in the abdomen are common. There is sometimes violent burning pain in the rectum. The pain varies in character from a mere aching to a severe griping; it is often intermittent and attended with rumbling of the bowels. It is chiefly confined to the umbilicus, but may extend over the whole abdomen; it is relieved by pressure. In some cases the abdomen is tense and puffy, in others retracted. The tongue is generally foul and furred, and sometimes red at the tip and edges; there is great thirst. The appetite is impaired. Diarrhœa is often attended with cramps in the calves and coldness of the limbs. In children diarrhœa is often associated with aphthæ.

Varieties: *Congestive diarrhœa.*—It generally results from mechanical obstruction to the flow of blood from the portal vein. In such cases draining of serum into the bowels takes place. The dejections vary; they may be thin and fæculent, as if fæces were mixed with serous transudation, or consist almost entirely of watery fluid.

Inflammatory diarrhœa, otherwise known as serous diarrhœa.—It is due to irritation which excites inflammation of the mucous membrane of the bowels. The contents of the bowels are mucous or serous fluid, with shreds of fibrine or even pus. The disease often extends to the large bowel, and the stools become more frequent, scanty, and may contain streaks of blood. Such a complication is attended with violent straining.

Irritative or fæculent diarrhœa.—In this variety the diarrhœa is a simple flux, and is often due to the presence of irritating substances in the intestines. It occurs in children during dentition, and is the most common form of diarrhœa. In the case of children the stools are like pale clay, and contain masses of undigested casein. The evacuations soon become greenish from contact with acid urine; in other cases the stools are greenish when passed, and are also acid, thus irritating the anus and the genitals. If this kind of diarrhœa be not soon relieved, it passes into a chronic form, or into inflammatory diarrhœa, or dysentery.

Vicarious diarrhœa.—It occurs in cases where the functions of the lungs, kidneys, or skin are interfered with or suppressed.

state of the bowels, upon the constitutional dyscrasia, and upon the diseased condition of some other organs. In fatal cases various lesions are found. The exudation products are not sufficient for the repair of the ulcers by granulation and cicatrisation. The difficulty increases owing to the ulcers being disturbed by the peristaltic movements, by the presence of flatus, fæces, or undigested food, and by the acrid secretions of the liver and pancreas. They thus become the seat of renewed congestion and inflammation. The muscular coat is thickened from infiltration. The ulcers are unhealthy looking, their sides and floor are formed of disorganised tissue. The ulcers may affect all the coats of the intestines; they now and then lead to fatal perforation or fatal hæmorrhage. In some cases the intestines are atrophied and attenuated; in others there is considerable thickening, which in thin persons is discoverable by palpation. In cases of chronic dysentery with ulceration, multiple abscesses are not unfrequently found in the liver.

Symptoms of chronic dysentery.—There is more or less diarrhœa, alternating with constipation and frequent abdominal pain and tenderness. Tenesmus is present, but only in a slight degree, if the cæcum or the colon is affected. The sphincter in some cases is completely paralysed. There is sometimes fever towards evening. The stools are copious, of a faint and sickly odour, generally unformed, and often covered with serous exudation, slime, mucus, or blood. Sometimes they are more or less liquid, and contain muco-purulent matter and serum, or blood mixed with fæces; sometimes they are gelatinous, white, and albuminous in appearance; in other cases they are frothy, pale yellow or green in colour. Occasionally there is hæmorrhage from the bowels. Every stool is found on washing to contain dysenteric products. After the disease has continued for a long time the appetite fails, and vomiting is often present. The gums are pale, sometimes livid and ulcerated; the tongue is in some cases dry and glazed, in others furred or fissured. The patient becomes more and more emaciated, has a sallow and cachectic countenance, the abdomen is tumid and hard, and there is local tenderness, swelling of the feet, exhaustion, and hectic fever. The disease may last for years, death taking place gradually from asthenia.

Duration and terminations.—In favorable cases the disease subsides in from six to eight days, the fever diminishes, the stools lose their dysenteric character, are less frequent, and resume their natural appearance. The remaining symptoms speedily subside, and improvement soon becomes manifest. Relapses are, however, not uncommon, and a chronic stage may supervene, which may be often aphthæ on the lips and tongue, and hectic with exhaustion sets in.

Fatty diarrhœa.—In many cases of indigestion free fat or oil appears in large quantities in the dejections. This generally occurs when the bile and pancreatic secretion fail to reach the intestinal canal. Opium has a marked effect in producing fatty stools. The evacuations are usually liquid and highly fœtid.

Terminations.—In slight cases recovery follows. Where diarrhœa is profuse, and lasts for many days or weeks, the patient emaciates, and may die from exhaustion. Sometimes it terminates in dysentery or enteritis. In children it may give rise to convulsions. It often merges into a chronic form, both in children and adults. This change occurs either when the diarrhœa has lasted for some time, or when it is kept up by improper food, exposure to chills, &c. In India a form of chronic diarrhœa is known as *white flux*. Other forms are due to tubercles in the intestines and to liver disease. The affection is characterised by progressive emaciation and great exhaustion. The abdomen is tense, puffy, and often tender. The tongue is generally furred and moist. There is constant rumbling in the abdomen, some loss of appetite, but no nausea. The evacuations in "white flux" consist of soft, white material, passed with much straining. There is a constant feeling of discomfort in the lower part of the rectum, and often pain in the bowels generally. This complaint, as it occurs in the hill stations in India, often subsides spontaneously if the patient is kept warm and in bed, but recurs on exposure. Relapses are common.

Diagnosis.—Diarrhœa may be mistaken for epidemic cholera, dysentery, and mucous irritation of the bowels from retention of fæces. The presence of bile in the evacuations excludes cholera. In this latter there is absence of the ordinary causes of diarrhœa, the stools are colourless and like rice-water, and there is suppression of urine and early collapse. The vomited matter is merely a colourless fluid, and not bile or undigested food, as in diarrhœa. With regard to dysentery, frequent calls to stool, scanty evacuations of mucus and blood, passed with severe straining, exclude diarrhœa. The dysenteric evacuations are, however, at first thin, watery, and fæculent. In diarrhœa there is no tenesmus, no marked pain or tenderness in the regions of the cæcum or sigmoid flexure. In mucous irritation of the bowels there is retention of fæces, as can be felt by a finger in the rectum. There are frequent thin, scanty, muco-fæculent, or only mucous stools, passed with straining.

Treatment of diarrhœa generally.—The treatment must be shaped according to the nature of the cause. If due to irritating contents,

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Prognosis.—It is very unfavorable if there be an existing epidemic, and also if the attack is severe, the temperature persistently high, the pulse quick and feeble, the stools resembling washings of flesh, and containing gangrenous products. Other unfavorable symptoms are, asthenia, long duration of the attack, inflammatory mischief in the liver, severe hæmorrhage from the bowels or other parts, and symptoms of collapse. If the pain and tenderness, previously severe, should rapidly subside, a fatal result is almost certainly imminent. In favorable cases there is (1) no complication; (2) little constitutional disturbance; (3) pulse steady, firm, and of almost normal frequency; (4) slight tenderness; (5) no tympanites; (6) very little anxiety of countenance; (7) dejections free from sloughs and other putrid matters; (8) tormina and tenesmus gradually lessen with the appearance of fæculent matter in the stools, and the dysenteric products become less and less marked as the case advances; (9) health improves with return of appetite and digestion.

Treatment.—In the earliest stage of acute dysentery a dose of castor-oil with or without tincture of opium is often sufficient. It is certainly indicated whenever indigestible food has been indulged in shortly before the attack. As a general rule, however, even the mildest purgatives must be given with extreme caution. For some cases enemata of tepid water are preferable. If the symptoms are not checked by the castor-oil, or if the patient does not come under treatment until the exudation stage has been reached, it is better at once to have recourse to ipecacuanha which is almost a specific in many cases. The best method of giving it is as follows: the patient is of course in bed, and a mustard plaster should be applied to the pit of the stomach for fifteen or twenty minutes. About thirty grains of ipecacuanha, made into a suitable bolus with mucilage, or into large pills if the patient cannot swallow the bolus, are then to be given. After taking the bolus the patient must keep as quiet as possible; movements of all kinds, and even speaking, must be prohibited. If thirst be great, teaspoonfuls of cold water may be allowed, or a little ice, when procurable. The patient should steadily resist all inclination to vomit; more or less nausea is generally experienced, but with care the ipecacuanha

can generally be retained. If the medicine be rejected, several hours must elapse before the dose is repeated. In some cases tolerance of the drug may be procured by giving a quarter of a grain of morphia half an hour previously; but, as a general rule, the use of an opiate is not desirable owing to its action on the liver.

It often happens that the good effects of the ipecacuanha are manifested after the first dose. The abdominal pain and tenesmus abate, the discharges from the bowels become less frequent and more fæculent in character, perspiration is induced and refreshing sleep is often obtained. It may, however, be necessary to administer two or even more doses of the medicine at intervals of from twelve to twenty-four hours. When the symptoms subside, and especially when mucus and blood are no longer discharged, the medicine should be discontinued altogether, or it may be given in four or five-grain doses, night and morning, for several days. If further treatment be required, the ordinary vegetable astringents may be given. Hot fomentations to the abdomen, or mustard plasters, may be applied from time to time for the relief of the local symptoms. Milk diet is the most suitable, but if there be much depression, a little beef-essence and brandy may be allowed. Some days should elapse before solids are taken, and the greatest precautions are necessary for some time with regard to the diet. The patient should remain in bed so long as there are any symptoms of the disease, and should be kept quiet and warm.

In cases in which the disease is complicated by a malarious taint, quinine in full doses should be combined with the ipecacuanha treatment. A paroxysm of fever will, in all probability, profoundly aggravate the dysenteric symptoms, and should therefore be prevented. From ten to twenty grains of quinine may be given in the interval between the doses of ipecacuanha.

For dysentery occurring in pregnant women, the ipecacuanha treatment is the best that can be adopted, inasmuch as it generally cuts short the disease. Unless this result can be obtained, abortion or premature labour is likely to occur, and frequently with fatal consequences.

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grain for a dose will suffice. The dose may be increased by adding one grain for each additional year till the dose for adults be reached. The drug may be given night and morning till the tormina and tenesmus diminish or disappear, and the slimy or bloody stools are replaced by fæculent motions. If, after three or four days of continued use of the ipecacuanha, the stools still remain the same, astringents, as chalk, bismuth, aromatic powder, and carbonate of soda may be added.

For bilious dysentery quinine with saline purgatives, as cream of tartar, tartarated soda, or citrate of magnesia, judiciously given in purgative doses, till large watery stools tinged with bile are produced, is of great value. The watery evacuations greatly relieve the portal congestion, and lessen the amount of blood in the stomach, spleen, pancreas, and intestines, and also remove the scybalous and putrid fæces which irritate the bowels.

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In chronic dysentery the removal of the patient from the malarious locality to a bracing climate is beneficial. Regulation of the diet, rest to the bowels, change of air, sea voyage, constant use of warm clothing and flannel next the skin, and a water compress over the abdomen for some hours daily, are all likely to be beneficial. The compress acts as a fomentation and favours the absorption of fibrine effused between the intestinal coats.

In these chronic cases the chief indications for treatment are (1) to restore the function of the liver; (2) to suppress the excessive local action of the intestines; and (3) to improve the general condition of the patient. If the bowels act too frequently various astringents should be employed. The principal of these are acetate of lead, sulphate of copper, nitrate of silver, catechu, kino, and rhatany. Where there is disorder of the liver a course of nitro-muriatic acid, with nux vomica and henbane, is often beneficial. When, as often happens, anæmia is present, the various preparations of iron are indicated. In some cases the tincture of the perchloride, combined with chloride of ammonium, is very suitable. The citrate of iron and quinine and a solution of the pernitrate are also recommended. Other remedies for chronic dysentery are bael fruit, eucalyptus, guarana, and hamamelis. Where there is any scorbutic or purpuric taint, lime-juice, claret, and oranges should be freely given. Quinine is generally useful in all cases of chronic dysentery. Another remedy, which frequently produces very satisfactory results, is the perchloride of mercury, given in very small doses, and combined with quinine; alum is also sometimes useful. Counter-irritation over the abdomen is often beneficial; mustard plasters or slight blisters may be employed. When the lower portion of the bowel is mainly affected enemata, containing a grain of nitrate of silver to the ounce, or acetate of lead and opium, are indicated.

The diet should consist of those articles which are most readily digested in the stomach. Good port wine or sherry or weak brandy and water may be allowed in moderation. Every effort should be made to improve the state of the general health. Sir Joseph Fayrer recommends a pure milk diet, with the occasional employment of lime-water, five-minim doses of laudanum, and a saline aperient, when indicated to remove portal plethora. Three or four quarts of milk may be taken in the twenty-four hours with very satisfactory results.

CHOLERA, ASIATIC—MALIGNANT CHOLERA.

This is a specific disease, consisting of a peculiar catarrh localised in the intestines. It is characterised by looseness of the bowels, with evacuations like rice-water, vomiting, cramps, prostration of strength, suppression of bile and urine, and collapse. It is known as malignant, Asiatic, serous, or spasmodic cholera. It is also called algide cholera from the coldness of the surface, which is one

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In chronic dysentery the removal of the patient from the malarious locality to a bracing climate is beneficial. Regulation of the diet, rest to the bowels, change of air, sea voyage, constant use of warm clothing and flannel next the skin, and a water compress over the reduced to a skeleton. Pain is no longer felt owing to the loss of sensibility. The sudden fall of temperature with the cessation of pain is a bad symptom. The dejections are dark, watery, and highly fœtid, and contain sloughs and exudation looking like washings of beef. Sometimes, muscular fibres may be discovered in the dejecta. The colon is felt to be swollen and thickened. The stools are passed involuntarily in bed. Hiccough comes on, the sphincters are relaxed ; exhaustion is sometimes increased by hæmorrhage from the bowels. The patient eventually dies. In some cases perforation and peritonitis precede death. In favorable cases, the local and general symptoms become milder, the tormina and tenesmus are less severe ; the dejections, which consisted of sloughs, mucus, and blood, now improve, and a little thin fæculent matter begins to appear in the stools. The patient feels relief from his painful symptoms, the appetite returns, the tongue becomes clean, and the strength improves. The pulse increases in volume and becomes less frequent. In a small proportion of cases the sloughing passes into gangrene, and large portions of the mucous membrane, and of the muscular coat are affected. Such cases are attended with extreme prostration and collapse. The pain, which before gangrene set in was excruciating, now altogether disappears. The stools consist of watery products of a dark colour, and have a highly offensive and gangrenous odour. The abdomen now becomes tympanitic and free from tenderness. The face is haggard, the skin is cold and clammy, the tongue is dry, furred, and brown ; the pulse is thready and irregular ; there are involuntary passages of urine and fæces, and the patient dies exhausted, generally before the end of the second week.

Dysentery often exhibits various modifications. Thus, in some epidemics, the patient is suddenly attacked with fever, and the bowels being constipated, he takes a dose of some purgative medicine. After this has acted upon the bowels the dysenteric symptoms follow. In other cases the dysenteric symptoms are observed from the very first, and are referred to the colon, cæcum, or rectum. When confined to the rectum the patient is compelled to remain long at stool ; he passes a little mucus and very little fæculent matter. The stools are frequent, very offensive, but there is only slight uneasiness in the abdomen. There is often a burning sensation at the anus; after an evacuation relief is obtained, but in a few minutes pain recurs, and is more agonising than before, and the patient has to go to stool perhaps twenty or thirty times in twenty-four hours. When the dysenteric lesions are seated in the cæcum or colon, there is much less tenesmus, but there is primary fever. Another modification is shown by cases which commence with diarrhœa or mere uneasiness of the chief symptoms of this disease. It is endemic in some localities, and often epidemic. It runs a very rapid and violent course, and is unattended with any structural change. It is capable of being communicated to healthy persons through the dejecta of patients suffering from the disease.

Causes.—The origin of cholera is involved in obscurity, and the way in which the disease is propagated, and the mode of its development and decline, are facts which are not yet capable of full explanation. The disease is very common, and has existed for centuries in India, where scarcely a year has passed in which its ravages have not been repeated since the *first perfectly recorded* epidemic in 1817, when it spread throughout Hindostan. Like specific fevers, it does not advance in the course or direction of the wind. We can form no conjecture respecting the movements of cholera; but it is apt to travel along the lines of human intercourse, and a certain amount of moisture and heat is necessary for the propagation of the disease. Should there be a heavy downpour of rain the disease shows a tendency to decline. It also dies out during the cold weather. History directs us to the delta of the Ganges as the birthplace of the disease. The cholera germ is supposed to develop in India on diseased rice. It is said that the poison is developed when the dejections of cholera patients are thrown into the cesspools, that volatile emanations arise capable of communicating the disease, and also that the water contaminated with the dejections or with any organic matter passed from cholera patients enters into the interstices of porous soil, and that the poison is then developed and the disease propagated. Damp or low situations and other insalubrious conditions increase the virulence and favour the spread of the poison. In the dried excreta of cholera patients the poison retains its virulence for a long time. It causes havoc in a population predisposed to disease in proportion to the unfavorable hygienic conditions. All ages are susceptible to it. Errors in diet, filth, overcrowding, bad drainage, and all other deleterious conditions help to diminish the resisting power of the organism. One great peculiarity is its strikingly partial distribution. Thus, one portion of a street may suffer most severely, while another may escape altogether.

The records of prisons and various asylums show that the disease is often confined to one ward or to one series of rooms. In severe epidemics the strong and robust are as liable to an attack as the weak and delicate. Those who display great anxiety, who take purgatives unnecessarily or stimulants to excess, are especially likely to be attacked. Persons attending on the patients run no especial risk unless they swallow the organic poison passed by the sick. The examination of the discharges and the inhalation of the effluvia arising from them involve little if any risk under proper precautions with regard to ventilation. During post-mortem examinations of cholera patients, the discharges have often come in contact with the face and lips, and in many cases with abraded surfaces, without any ill effects.

A most important contribution on the subject of the causation of cholera was made in 1883 by Dr. Koch, of Berlin. As a result of his investigations in Egypt, where the disease then prevailed, he arrived at the conclusion that certain peculiar bacteria are constantly present in the intestines of persons suffering from cholera. He did not succeed in discovering any organised infective material in the blood or in those organs which, in the case of other infective diseases, are usually the seat of micro-parasites, viz. the lungs, spleen, kidneys, and liver. The contents of the bowel and the dejections of the patients were found to contain many organisms belonging to the most different varieties, none of which appeared in preponderating proportions.

In the coats of the bowel, on the other hand, the peculiar bacteria were found in great numbers. They had penetrated the glands and the epithelium and had passed into the deeper layers, and in some cases even into the muscular coat. The chief seat of these changes was found to be the lower portion of the small intestine. The bacteria in question were rod-shaped, and in size most nearly resembled those found in glanders. In a subsequent report, Dr. Koch states that the bacilli are not quite straight, but a little curved, like a comma. This curving may be even so marked that the bacilli assume an almost semi-circular outline. Dr. Koch's researches have led him to believe that these *comma-like bacilli are altogether peculiar to cholera*, and he asserts that the disease arises only when these specific organisms have found their way into the bowel. The first appearance of the bacteria coincides with the beginning of the disease; they increase in number proportionately to its advance, being found in great abundance in the inodorous watery evacuations, and they disappear as the disease declines.

Various objections have been urged against Dr. Koch's theory, some of which require a brief notice. In the first place, this comma-shaped bacillus has not been found in the blood or tissues in any stage of cholera. Whatever the cause of the disease may be, the entrance of a cholera poison through the respiratory organs is an established fact, and hence we should expect to find the bacilli (if they are the cause of the disease) in the lungs and blood. Secondly, the symptoms and nature of cholera show that it is not a *local* disorder of the alimentary canal, but that this latter is only death and alter the appearance of the body. The eyes are sunk in the orbit, and surrounded by wide blue rings, the eyelids are half closed; the uncovered parts of the eyeballs are dry; the nose is pointed, the cheeks sunken, the lips bluish. Elsewhere there is cyanosis, which is most marked in the terminal phalanges of the fingers and toes. The subcutaneous connective tissues are hard and dry, and the muscles are deep red. The blood is thick and dark having lost much of its water. The tissues and internal organs have undergone alterations, resulting from the physical and chemical changes in the blood. The right cavities of the heart and the veins are full, the left cavities and the arteries are empty. The cerebral sinuses are distended with dark blood and the brain substance is dry. There is no serum in the pericardium. The surfaces of the pleura and pericardium are covered with an adhesive layer, and often present small ecchymoses. The mucous membrane of the stomach and small intestines is injected and swollen. The epithelial cells contain micrococci, and the epithelium generally falls off the surface of the membrane in large patches an hour or two after death. The small intestine is collapsed, it has a rosy hue, the large intestine is of a natural colour. The intestines contain a large quantity of faintly coloured fluid, with flocculi suspended in it. The mucous membrane is easily lacerable. The intestinal walls, the solitary and the Peyer's glands are swollen and œdematous. The intestinal villi are stripped of their epithelium, fragments of which form the shreds and flocculi which are suspended in the fluid. Other portions are only semi-detached from the bowel, and others again appear to be elevated by subjacent effusion. The large intestines and the jejunum are generally natural. The gall-bladder is distended. Sometimes the kidneys are hyperæmic; the bladder is contracted and generally empty.

If death occurs during the stage of reaction, the blood is more fluid, and less dark. The lungs are not dry, but œdematous; pneumonic inflammation occurs, and the contents of the intestines are coloured with bile. Sometimes there is diphtheritic inflammation of the intestines; sometimes rupture of the spleen; sometimes albuminous urine in the bladder.

Symptoms.—There is a period of incubation, varying from one or two hours to three or four days. When cholera is most virulent as at the commencement of an epidemic, there are no premonitory symptoms. The patient is well within a few hours of the attack, or he may go to bed quite well and during the night, or on rising, violent vomiting and purging set in. Shortly after the epidemic has broken out, the disease generally begins with diarrhœa, with copious watery evacuations from the intestines, though in some rapidly fatal cases even these are absent. This is soon followed by great prostration of strength, with a feeling of sinking at the epigastrium. At the outset of the attack there is a feeling of nausea, but seldom vomiting. These symptoms constitute the first stage of cholera, from which, under proper treatment, recovery often takes place. If the disease progresses, it passes through other stages which may be described as: 1. The stage of characteristic fluxes with vomiting. 2. The algide stage. 3. The stage of reaction.

The characteristic stage of evacuation commences with rice-water stools. These are very frequent, and after each evacuation some relief follows. The patient now commences to vomit, and these symptoms are followed by cramps, laborious respirations, lividity, coldness of the body, sinking of the pulse, and collapse. There is congestion of the portal system, with suspension of the hepatic functions. In such cases the dejections consist at first only of the contents of the bowels, and are passed without pain. The evacuations become very copious, and contain abundant minute white flocculi; they are generally inodorous, but in some cases they have a peculiar fœtor. They are accompanied by copious vomiting. The vomited matters at first consist only of the contents of the stomach, but afterwards contain all the water the patient drinks and medicines, mixed with sero-mucous fluid, bile, and disintegrated epithelium. The vomiting is sometimes attended with exhausting and forcible retching, which adds to the prostration. Even a spoonful of iced water cannot be retained. There is great thirst and severe burning heat at the pit of the stomach, and severe pain from cramps in the calves and legs. The patient is extremely exhausted; there is restlessness and jactitation; the abdomen is retracted and stiff when touched. The tongue is covered with a thin fur, is pasty or dry, and often protruded between the lips. The patient constantly craves for water to quench his thirst. Although the temperature of the body is below the normal he tosses his arms and throws off his bedclothes, as if to relieve himself from heat or to keep himself cool. He gasps for breath, and sleeps for a few minutes with eyes half closed and the brows contracted and frowning. The features are drawn; the nose sharpened and thin; the cheeks sunken; the face pinched, ghastly, and livid; the eyes look hollow and shrunken. The surface of the body is cold, bedewed with dampness, and assumes generally a leaden hue. The fingers are shrunken and wrinkled, the nails blue, and the hands look like claws. The pulse is extremely frequent, weak, and small at first, and soon becomes imperceptible. The urine now becomes scanty and albuminous, or even suppressed. The respirations are irregular and hurried. The

Dysentery may also be mistaken for other diseases in which intestinal hæmorrhage is a symptom. Examination of the rectum may reveal the presence of a polypus or of hæmorrhoids, or there may be a history of purpura or of typhoid fever. The disease is distinguished from fissure or ulcer in the rectum by the fluid or loose character of the stools, by the existence of dysenteric products, and by the results of examination.

Prognosis.—It is very unfavorable if there be an existing epidemic, and also if the attack is severe, the temperature persistently high, the pulse quick and feeble, the stools resembling washings of flesh, and containing gangrenous products. Other unfavorable symptoms are, asthenia, long duration of the attack, inflammatory mischief in the liver, severe hæmorrhage from the bowels or other parts, and symptoms of collapse. If the pain and tenderness, previously severe, should rapidly subside, a fatal result is almost certainly imminent. In favorable cases there is (1) no complication; (2) little constitutional disturbance; (3) pulse steady, firm, and of almost normal frequency; (4) slight tenderness; (5) no tympanites; (6) very little anxiety of countenance; (7) dejections free from sloughs and other putrid matters; (8) tormina and tenesmus gradually lessen with the appearance of fæculent matter in the stools, and the dysenteric products become less and less marked as the case advances; (9) health improves with return of appetite and digestion.

Treatment.—In the earliest stage of acute dysentery a dose of castor-oil with or without tincture of opium is often sufficient. It is certainly indicated whenever indigestible food has been indulged in shortly before the attack. As a general rule, however, even the mildest purgatives must be given with extreme caution. For some cases enemata of tepid water are preferable. If the symptoms are not checked by the castor-oil, or if the patient does not come under treatment until the exudation stage has been reached, it is better at once to have recourse to ipecacuanha which is almost a specific in many cases. The best method of giving it is as follows: the patient is of course in bed, and a mustard plaster should be applied to the pit of the stomach for fifteen or twenty minutes. About thirty grains of ipecacuanha, made into a suitable bolus with mucilage, or into large pills if the patient cannot swallow the bolus, are then to be given. After taking the bolus the patient must keep as quiet as possible; movements of all kinds, and even speaking, must be prohibited. If thirst be great, teaspoonfuls of cold water may be allowed, or a little ice, when procurable. The patient should steadily resist all inclination to vomit; more or less nausea is generally experienced, but with care the ipecacuanha

rapidly fatal cases even these are absent. This is soon followed by great prostration of strength, with a feeling of sinking at the epigastrium. At the outset of the attack there is a feeling of nausea, but seldom vomiting. These symptoms constitute the first stage of cholera, from which, under proper treatment, recovery often takes place. If the disease progresses, it passes through other stages which may be described as: 1. The stage of characteristic fluxes with vomiting. 2. The algide stage. 3. The stage of reaction.

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grain for a dose will suffice. The dose may be increased by adding one grain for each additional year till the dose for adults be reached. The drug may be given night and morning till the tormina and tenesmus diminish or disappear, and the slimy or bloody stools are replaced by fæculent motions. If, after three or four days of continued use of the ipecacuanha, the stools still remain the same, astringents, as chalk, bismuth, aromatic powder, and carbonate of soda may be added.

For bilious dysentery quinine with saline purgatives, as cream of tartar, tartarated soda, or citrate of magnesia, judiciously given in purgative doses, till large watery stools tinged with bile are produced, is of great value. The watery evacuations greatly relieve the portal congestion, and lessen the amount of blood in the stomach, spleen, pancreas, and intestines, and also remove the scybalous and putrid fæces which irritate the bowels.

The administration of ipecacuanha in dysentery requires a few words of comment. In a vast number of cases it produces the happiest results. It is, however, unsuccessful in cases where there is coexistence of hepatic abscess or obstinate malarial fever. In dysentery complicated with Bright's disease or Addison's disease ipecacuanha generally fails. Its advantages are, (1) its administration is simple; (2) it does not affect the health in any way; (3) it checks inflammation; (4) it is beneficial in all the stages of dysentery except the sloughing and gangrenous; (5) the repair is rapid by resolution or by granulation; (6) Under its use mercurials and bloodletting can be avoided; (7) convalescence is hastened; (8) there is less chance of the disease becoming chronic; (9) it seldom or never leads to hepatic complication; (10) opium is not required. When given in full doses its effects are antiphlogistic, sudorific, cholagogue, and sedative.

1. It subdues inflammation without any loss of blood. 2. It diminishes and removes the inflammatory exudation products just as mercurial preparations or purgatives would do, but without any irritating effects. 3. The good effects of antimonials and other sudorifics are produced with certainty by ipecacuanha, and the sedative effects of this drug are far more satisfactory than those of opium in dysentery. 4. Ipecacuanha may give rise to nausea and vomiting, but these are only temporary. 5. The dysenteric symptoms subside rapidly, sleep is restored, and assimilation and digestion are improved.

In chronic dysentery the removal of the patient from the malarious locality to a bracing climate is beneficial. Regulation of the diet, rest to the bowels, change of air, sea voyage, constant use of warm thing and flannel next the skin, and a water compress over the organs, now begins to appear in the extremities. The temperature rises to the normal degree. The suppressed secretion of bile, saliva, and urine shows signs of restoration. All these phenomena take place simultaneously. The purging, vomiting, and thirst gradually become less; the face is flushed; respiration and circulation return to their normal state; the pulse, which was imperceptible, now begins to rise; the restlessness and jactitation subside, and there is a disposition to sleep. After twenty-four hours the patient may pass a little urine, and the stools become faint yellow or dark coloured. This favorable end is often thwarted by various complications. In unfavorable cases the reaction is only temporary, and is followed by meningitis or pulmonary congestion, leading to death in from six to twenty-four hours. In some cases the reaction is very high, and ultimately merges into typhoid symptoms and death.

In cases where opium is used largely in the early stage it often happens that with the reaction the renal secretion is not re-established, but there is complete and fatal suppression of urine.

Cholera has a peculiar influence over females, and especially during gestation. Thus, during the stage of collapse we notice in them a sanguineous discharge from the vagina; and if the disease occurs during the early months of gestation abortion generally results, but if the disease occurs at a later period the fœtus is always found to be dead in the womb. In such cases the female perspires very profusely, she has a copious discharge from the vagina, and there is absence of fœtal heart-sounds. In the case of suckling women, the milk continues to be freely secreted, although the urine and bile are generally suppressed.

Characters of the stools in cholera.—The absence of colour chiefly depends on the great watery discharge. There is abundance of water, large quantities of epithelium in the form of [illegible] scattered granules, little albumen, and large quantities of salts, especially the chloride of sodium. There may also be triple phosphates and blood-corpuscles. Where the stools are [illegible] and the patient also collapsed, recovery scarcely ever takes place.

Complications and sequelæ.—During the reaction various skin diseases, such as herpes, urticaria, or roseola may appear and other complications may arise, as swelling of the glands or of the parotids, catarrhal bronchitis, or pneumonia. [illegible] [illegible] is a frequent sequel. Other sequelæ are [illegible] [illegible], sloughing of the cornea, abscesses over the body, [illegible] in the right heart and pulmonary arteries, and hæmorrhage from the bowels.

Treatment.—In the early stages of cholera, the [illegible] [illegible] [illegible] of the chief symptoms of this disease. It is endemic in some localities, and often epidemic. It runs a very rapid and violent course, and is unattended with any structural change. It is capable of being communicated to healthy persons through the dejecta of patients suffering from the disease.

Causes.—The origin of cholera is involved in obscurity, and the way in which the disease is propagated, and the mode of its development and decline, are facts which are not yet capable of full explanation. The disease is very common, and has existed for centuries in India, where scarcely a year has passed in which its ravages have not been repeated since the *first perfectly recorded* epidemic in 1817, when it spread throughout Hindostan. Like specific fevers, it does not advance in the course or direction of the wind. We can form no conjecture respecting the movements of cholera; but it is apt to travel along the lines of human intercourse, and a certain amount of moisture and heat is necessary for the propagation of the disease. Should there be a heavy downpour of rain the disease shows a tendency to decline. It also dies out during the cold weather. History directs us to the delta of the Ganges as the birthplace of the disease. The cholera germ is supposed to develop in India on diseased rice. It is said that the poison is developed when the dejections of cholera patients are thrown into the cesspools, that volatile emanations arise capable of communicating the disease, and also that the water contaminated with the dejections or with any organic matter passed from cholera patients enters into the interstices of porous soil, and that the poison is then developed and the disease propagated. Damp or low situations and other insalubrious conditions increase the virulence and favour the spread of the poison. In the dried excreta of cholera patients the poison retains its virulence for a long time. It causes havoc in a population predisposed to disease in proportion to the unfavorable hygienic conditions. All ages are susceptible to it. Errors in diet, filth, overcrowding, bad drainage, and all other deleterious conditions help to diminish the resisting power of the organism. One great peculiarity is its strikingly partial distribution. Thus, one portion of a street may suffer most severely, while another may escape altogether.

The records of prisons and various asylums show that the disease is often confined to one ward or to one series of rooms. In severe epidemics the strong and robust are as liable to an attack as the weak and delicate. Those who display great anxiety, who take purgatives unnecessarily or stimulants to excess, are especially likely to be attacked. Persons attending on the patients run no especial risk unless they swallow the organic poison passed by the supervene it will be necessary to have recourse to stimulants, such as carbonate of ammonia and ether, with wine or brandy.

Other methods of treatment for cholera have been recommended. If opium has no effect in checking the diarrhœa, and collapse rapidly sets in, it has been advised to give one grain of calomel every hour, and apply cold compresses frequently to the abdomen. The plan of injecting saline solutions into the veins has fallen into desuetude, and the same remark applies to the castor-oil treatment, which was warmly advocated some years ago. Great success has been claimed for dilute sulphuric acid, given in doses of twenty minims with some aromatic water.

Although opium is perhaps the most valuable remedy in the treatment of cholera, certain precautions are necessary with regard to its use. It should not be given where there is suppression of urine, and in advanced cases, as in collapse, it is not only useless, but also mischievous. It is useless, because very little is then absorbed, it being for the most part returned unchanged, or merely diluted with the discharges from the stomach and intestines; it is injurious because during reaction the opium that is retained may suddenly become absorbed and lead to stupor, and promote uræmic intoxication. For the suppression of urine leaves of digitalis, soaked in hot water and applied to the pubes, cupping over the loins, or frictions with belladonna and chloroform liniments, may be tried. In some cases turpentine, even when applied externally, has a specially powerful diuretic action, and under its use patients pass urine when in an apparently advanced stage of collapse. Sometimes patients are requested to drink plenty of water, so as to add fluid to the blood. Tincture of cantharides internally has been employed with good results.

Preventive treatment is of great importance whenever an invasion of cholera is threatening. Among persons already exposed to the poison four or five days will elapse before the disease manifests itself. The following are the most important prophylactic measures: —1. The condition and source of the local water supply must be carefully examined. 2. The milk should also be examined, as it is often diluted with impure water. 3. The use of water from surface wells and from those near drains and cesspools should be prohibited. 4. All water for drinking purposes should be filtered and boiled. 5. All filth and refuse should be promptly removed, and all dirty places disinfected and cleansed. 6. The stools and the vomited matters should be carefully disinfected and removed from the patient's room. The best disinfectants are carbolic acid, bichromate of potash, chloride of zinc, and sulphate of iron. 7. Every vessel in which the evacuations are received should have some disinfectant previously placed in it. 8. The disposal of the dejecta is a most important point. If practicable they should be buried at some depth in the earth, having been previously mixed with one or other of the disinfectants. If this method cannot be adopted, and it is necessary to make use of the ordinary drains, disinfection is still more imperative, and a solution of sulphate of iron, one ounce to a pint of water, should be frequently poured into the drain. It is dangerous to allow the evacuations to pass into a cesspool. In fatal cases the body must be removed and buried as speedily as possible. It is advisable to throw quicklime into the grave. The bedding, clothes, &c., should be burnt, and the room thoroughly disinfected by burning sulphur. The practice among the Hindus of burning the dead is to be advocated.

The vexed question of quarantine, with reference to cholera, requires a brief allusion. On this subject there is a great contrast between the views held in England and those of most of the continental States. The English opinion is that quarantine is useless, impracticable, and disastrous to commerce. In lieu of it the authorities have established a system of medical inspection, under which all ships free from disease are admitted without let or hindrance to her ports, while all ships in which cholera has occurred are rigorously disinfected, the patients are removed to an isolated hospital, and healthy persons are allowed to leave. Experience has shown that this substitute for quarantine gives the maximum of freedom with the minimum of risk.

Quarantine, as practised in some continental countries, is open to many objections. It can never be successfully enforced on a large scale. Instead of allowing cases of disease to be isolated and dealt with separately, it creates a vast reservoir of infection, and the disease gains in virulence by concentration. It has been shown, over and over again, that a disease may be converted into a pestilence by confining a number of human beings in crowded and unhealthy quarters; and the great objection to quarantine is that it creates the conditions most calculated to intensify the virulence of the disease.

CHOLERAIC DIARRHŒA.

Sporadic cases, closely resembling cholera, are often met with at a time when there is no epidemic of the disease. Choleraic diarrhœa is characterised by acute catarrh of the mucous membrane of the stomach and small intestines, attended by vomiting and purging. The stools consist of a serous exudation fluid containing a little albumen. The water from the body is rapidly lost, and the patient is soon exhausted or collapsed, but the disease is rarely fatal.

Rest to the intestines, ice to suck, and a mustard plaster to the abdomen are the principal remedies to be employed. If the purging be severe and serous, acetate of lead, with diluted acetic acid or a mixture of creasote with diluted acetic acid will often suffice. A dose or two of fifteen drops of tincture of opium will generally check the diarrhœa. Brandy in small and repeated doses is useful. If the vomiting be severe, ten grains of calomel should be placed on the tongue and followed by an effervescing mixture with hydrocyanic acid, and compound tincture of chloroform. If the diarrhœa be very obstinate, nitrate of silver combined with Dover's powder and camphor will generally be found efficacious.

INTESTINAL HÆMORRHAGE.

Intestinal hæmorrhage is otherwise called melæna. It signifies the escape of blood from the intestines. The discharge varies in colour and may consist of blood alone or of blood intimately mixed with fæculent matter. The hæmorrhage is a symptom of certain morbid conditions, and not an actual disease itself.

Causes.—It may arise from injuries and lesions in any part of the intestines. It often results from intestinal ulcers as in typhoid fever, dysentery, and tubercular disease; from varicose dilatations of the hæmorrhoidal veins and vascular growths. Other causes are increased blood pressure or extreme fluxion or congestion of the vessels, as in obstruction of the portal veins due to cirrhosis of the liver. An altered state of the blood or of the vessels is another cause. Hæmorrhages are sometimes noticed in purpura, the hæmorrhagic diathesis, scurvy, leucocythæmia, malarious fevers, and yellow fever.

Symptoms.—These are those of loss of blood generally, and of the diseased condition which is the cause of the hæmorrhage. In many cases the hæmorrhage is only trifling and there may be no marked symptoms, but where the bleeding is profuse the symptoms are those of rapid collapse, syncope, and death. Repeated hæmorrhages from the bowel lead to marked anæmia, general pallor, a failing pulse, and giddiness. In rare cases patients complain of a sensation of a warm fluid flowing into the abdomen. Hæmorrhage is salutary in a few cases. If due to chronic congestion, with or without hæmorrhoids, its effect is to relieve the distended blood-vessels. Moderate hæmorrhage in cases of typhoid fever has been known to be attended with benefit, but if profuse and after the twelfth day it is a formidable symptom.

Characters.—When the quantity of blood is excessive the bright red colour is retained. In moderate bleeding the evacuations vary death and alter the appearance of the body. The eyes are sunk in the orbit, and surrounded by wide blue rings, the eyelids are half closed; the uncovered parts of the eyeballs are dry; the nose is pointed, the cheeks sunken, the lips bluish. Elsewhere there is cyanosis, which is most marked in the terminal phalanges of the fingers and toes. The subcutaneous connective tissues are hard and dry, and the muscles are deep red. The blood is thick and dark having lost much of its water. The tissues and internal organs have undergone alterations, resulting from the physical and chemical changes in the blood. The right cavities of the heart and the veins are full, the left cavities and the arteries are empty. The cerebral sinuses are distended with dark blood and the brain substance is dry. There is no serum in the pericardium. The surfaces of the pleura and pericardium are covered with an adhesive layer, and often present small ecchymoses. The mucous membrane of the stomach and small intestines is injected and swollen. The epithelial cells contain micrococci, and the epithelium generally falls off the surface of the membrane in large patches an hour or two after death. The small intestine is collapsed, it has a rosy hue, the large intestine is of a natural colour. The intestines contain a large quantity of faintly coloured fluid, with flocculi suspended in it. The mucous membrane is easily lacerable. The intestinal walls, the solitary and the Peyer's glands are swollen and œdematous. The intestinal villi are stripped of their epithelium, fragments of which form the shreds and flocculi which are suspended in the fluid. Other portions are only semi-detached from the bowel, and others again appear to be elevated by subjacent effusion. The large intestines and the jejunum are generally natural. The gall-bladder is distended. Sometimes the kidneys are hyperæmic; the bladder is contracted and generally empty.

If death occurs during the stage of reaction, the blood is more fluid, and less dark. The lungs are not dry, but œdematous; pneumonic inflammation occurs, and the contents of the intestines are coloured with bile. Sometimes there is diphtheritic inflammation of the intestines; sometimes rupture of the spleen; sometimes albuminous urine in the bladder.

Symptoms.—There is a period of incubation, varying from one or two hours to three or four days. When cholera is most virulent as at the commencement of an epidemic, there are no premonitory symptoms. The patient is well within a few hours of the attack, or he may go to bed quite well and during the night, or on rising, violent vomiting and purging set in. Shortly after the epidemic has broken out, the disease generally begins with diarrhœa, with copious watery evacuations from the intestines, though in some

INTESTINAL OBSTRUCTION—ILEUS.

In this affection there is some mechanical obstruction to the passage onward of the contents of the intestinal canal, by causes or conditions occurring within the abdomen or pelvis.

Causes.—Intestinal obstruction is more common in males than in females, although some forms, as those which depend upon (1) impaction of gall-stones or of fæcal matter; (2) pressure from without as by tumours or displaced viscera; (3) constrictions by peritoneal or other adhesions, are more commonly met with in women. Intussusception is more frequent during childhood, while stricture of the bowel is more common at an advanced period of life. Conditions leading to obstruction may be congenital or acquired. The causes vary in (1) severity or acuteness of effect; (2) mode of action; and (3) nature. Some act by compression from without, others by constriction within; others again act by blocking the canal. Some causes act very suddenly and without warning, and lead to complete occlusion. Others again act very suddenly, and lead to serious symptoms, but do not cause complete occlusion, leaving chances of relief. Other causes again develop slowly, the symptoms are less acute, and more or less relief can be obtained.

Congenital cases depend upon abnormal development or peculiarity of intestines. *Acquired* cases are due to accident or disease. The obstruction may result from (1) compression; (2) impaction of foreign bodies, gall-stones, fæcal masses, concretions, &c.; (3) internal strangulation; (4) intussusception; (5) constriction.

The seat of obstruction varies. Every part of the intestine is liable to be affected, but some parts are more frequently involved than others. Ileo-cæcal invagination is common in children, intussusception of the ileum is met with exclusively in adults. Invagination of the colon and of the rectum is extremely rare. Internal strangulation may be due to peritoneal adhesions, or to bands formed by the omentum or mesentery, or to twisting of the intestine upon itself. It may also be caused by the vermiform process. In cases of torsion the sigmoid flexure is most often affected. The impaction of fæces or any foreign bodies rarely causes fatal obstruction. Various substances habitually taken sometimes accumulate and form intestinal concretions. Compression affects especially the small intestine. Intussusception involves the cæcum and colon, and next the ileum. Constrictions, due to morbid growths, are most common in the large intestine, especially in the lower part.

Symptoms. — Obstruction of the intestine is characterised by certain symptoms and physical signs. These vary with the cause, acuteness of the attack, and with the seat of obstruction.

(*a*) *Pain.*—This is the earliest and most constant symptom, and generally exhibits remissions and exacerbations. Sometimes, however, it is continuous and constant to the end. In impaction of a foreign body or gall-stone, at the commencement of intussusception and in strangulation occurring suddenly, the pain is acute and is often followed by faintness and even collapse. Strangulation as a result of twists gives rise to pain which comes on gradually but rapidly increases in severity. In cases of constriction the pain at the outset is slight. In compression due to tumours or displaced viscera, or by the impaction of fæces, there is little or no actual pain. As a rule such patients complain only of fulness, or discomfort. The *cause* and *character* of the pain vary according to the stages of obstruction. In the early stage, the cause of pain is the irritation of the mucous and serous coats of the portion of the intestine affected. In advanced cases the pain is associated with distension of the bowel, and is increased by the futile peristaltic efforts to move onwards the matter accumulated above the obstruction. In far advanced cases the pain is aggravated by the peritonitis and enteritis which supervene. In the early stage of strangulation and of impaction of gall-stones, the pain is increased by pressure on the diseased spot, but there is little or no general tenderness. In intussusception the pain is relieved by gentle pressure; it often causes great anxiety and distress.

(*b*) *Nausea and vomiting.*—In obstruction vomiting is a constant symptom. At the beginning it is generally sympathetic and due to shock. Where vomiting comes on later it is due to the regurgitation of the contents of the intestines into the stomach, or to reflex irritation due to injury or inflammation of the peritoneum. In cases of obstruction existing near the stomach early and constant vomiting is a marked symptom. In obstruction of the large intestine vomiting is delayed, and is not so prominent. Where the obstruction is in the upper part of the small intestine, but below the ductus communis choledochus, the vomited matter contains bile, and is but little offensive. In obstruction below the middle of the small intestine the vomited matter is fæculoid and very fœtid. When in the colon or lowest part of the ileum it may contain fæcal masses.

The regurgitation of the contents of the large into the small intestine is supposed to be due to great distension, rendering the ileo-cæcal valve inefficient. In health the contraction of the intestine on its contents presses them onwards; but in obstruction the contents, instead of passing onwards, pass backwards in the direction where there is least resistance.

(*c*) *Constipation.*—This constantly exists in intestinal obstruction. When it comes on suddenly it is a symptom of internal strangulation or of impaction of the intestines by gall-stones. When gradual it indicates stricture or compression. It may be absolute from the first, or may become so after a variable period, during which time fæces may be passed. Even after complete obstruction some portion of the fæcal contents may remain below the seat of mischief, and these being removed by injections may give the false idea that the occlusion is not complete, or that relief has been obtained. As a general rule, however, the bowel below the obstruction ceases to act.

In intussusception the obstruction is rarely complete from the first, though later on it becomes so from the effects of inflammatory swelling. In such cases there is sudden constipation at first, but after a time small quantities of fæces begin to pass, and are mixed with mucus and blood. Later on the evacuations consist of mucus and blood alone. In obstruction due to pressure of growths or compression by tumours constipation slowly occurs, and becomes absolute if there is twisting of the bowel or impaction of some portion of its contents. In constriction of the small intestine constipation occurs gradually.

(*d*) *Tympanitic distension of the abdomen.*—This symptom is common in cases of obstruction. The convolutions and peristaltic movements above the seat of obstruction can sometimes be seen and felt. The degree of distension and its rapidity vary in different cases with the cause and seat of obstruction. In acute internal strangulation the distension is rapid and severe; in chronic cases it is gradual. In intussusception distension is very rare. Distension is first found in the portion of the bowel just above the seat of obstruction, and gradually extends. It is a serious symptom, and when rapid and extensive the danger is great. The anatomical position of the intestines serves to indicate the seat of distension in any given case of obstruction; but when the mischief is seated low down the distension sooner or later becomes general.

(*e*) Besides the swelling there is more or less *tension* of the abdominal walls, but little or no tenderness. Sometimes moderate pressure gives relief. The movements of the bowels are accompanied by borborygmi, or gurgling noises and sensations. These cease when peritonitis comes on, or when the bowel becomes paralysed. Localised swellings in the abdomen are often observed. Thus in ileo-cæcal invagination there is a rounded cylindrical tumour in the right iliac region. In other parts tumours of various kinds may be either visible or detectable on palpation.

(f) Changes in the urine.—Where the occlusion occurs high up and is acute, as in strangulation, the excretion is scanty. This is due in great measure to reflex inhibitory influence exerted through the sympathetic upon the excretory function of the kidneys. Where the occlusion affects the sigmoid flexure or the rectum the flow is sometimes excessive, but there is not unfrequently retention of urine.

(g) Aspect of the patient.—The face is expressive of great suffering and distress. The mind is generally unaffected, although there is great depression of spirits and torpor from which the patient is roused by pain or vomiting. The pulse is small, frequent, and often thready towards the end. The temperature is as a rule low, except when enteritis or peritonitis is set up. Other troublesome symptoms are dyspnœa, hiccough, and severe thirst. Delirium, convulsions, and coma are occasionally present towards the close. Many patients die in a state of collapse, and this condition is sometimes noticed at the very commencement, as in acute strangulation or sudden impaction. In these cases it is due to shock, but when it occurs later on it is usually indicative of rupture of the intestine and peritonitis.

Diagnosis.—Obstruction of the bowel may be mistaken for hepatic or renal colic, ulcerative enteritis, perityphlitis, and peritonitis. In some cases the administration of ether or chloroform will facilitate the examination by relaxing the abdominal muscles and preventing pain. In every suspected case of acute strangulation the abdomen should be carefully examined with a view of discovering a hernial protrusion. In all cases of obstruction there is a mechanical cause. In other cases as peritonitis, typhlitis, &c., there is arrested action of the intestine. In every case the history, progress, signs, and symptoms must be carefully considered.

Course.—As a rule cases of obstruction of the bowel run a very unfavorable and rapid course. Death may occur either at an early period or later on as a result of some complication. In acute cases relief is sometimes obtained by treatment or by natural progress, suddenly and unexpectedly. In cases due to impaction relief often occurs. In other chronic cases death is almost certain to ensue in spite of surgical and medical assistance.

Complications.—The chief of these are (1) enteritis; (2) peritonitis; (3) ulceration and perforation of the bowels; (4) sloughing and gangrene of the invaginated portion; (5) hæmorrhage into the peritoneal sac or the bowels; (6) pneumonia due to pyæmia; (7) asphyxia; (8) uræmia; and (9) coma and syncope.

Duration.—Where obstruction is complete and near the stomach the progress is very rapid. In acute strangulation, and where obstruction is complete and sudden, death takes place in from a few hours to five or six days. In cases of compression, where obstruction is gradual, the condition may last for a protracted period, varying according to the circumstances of the case. The percentage of mortality, according to the various causes, is—

43 per cent. from intussusception.
17 „ „ stricture.
5 „ „ impaction.
27 „ „ internal strangulation.
8 „ „ compression.
—
100

Treatment.—In cases of intestinal obstruction treatment is often necessary before the true nature of the affection can be determined. As a rule drastic purgatives should be avoided, as they tend to increase the mischief. The chief aim should be to soothe rather than irritate the mucous membrane of the bowel. Should it happen that some aperient has been given without effect the medicine should not be repeated. Even in chronic cases, after relief is obtained from other treatment, and all urgent symptoms have subsided, caution is necessary in the use of aperients. Sedatives and antispasmodics, as opium and belladonna, are generally useful in all cases of obstruction. If opium cannot be retained by the stomach it should be administered through the rectum, or morphia with atropine may be injected hypodermically. In acute cases pain may be relieved by the inhalation of chloroform or ether, or of nitrite of amyl. In order to remove the obstruction large quantities of fluid may be injected into the rectum. Injections of large quantities of warm water by means of a stomach-pump tube have been found very successful. Injections of gruel, salad-oil, or of soap and water, or of salad-oil with turpentine, should be tried. Relief is sometimes obtained by putting the patient in bed with the thighs raised, and then administering a copious enema, and kneading the abdomen in various directions. Injection of air through the rectum is sometimes found successful in cases of intussusception. Where the symptoms of obstruction are associated with those of enteritis the application of a few leeches, followed by fomentations and poultices, is advisable. The free application of anodynes, as opium, belladonna, or aconite, to the skin of the abdomen, may be advantageously combined with the fomentations. The application of ice to the abdomen has done good in some cases. Electricity has also been recommended, one pole being placed on the surface in the right iliac region. In other parts tumours of various kinds may be either visible or detectible on palpation.

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The surface of the body is cold; the temperature may be as low as 95° F. The face is anxious and pinched, the eyeballs sunken, the pulse feeble, and the respirations quick. The urine is scanty, and often suppressed. All these symptoms gradually become less, and the patient ultimately recovers. He falls off to sleep, and wakes exhausted but refreshed.

Diagnosis.—The diagnosis of choleraic diarrhœa from Asiatic cholera is sometimes extremely difficult. In the case of Asiatic cholera the patient must have imbibed the poison which produces this disease. If there be even sporadic cases of cholera in the neghbourhood the history of the case, especially with regard to the nature of the food taken, and various other conditions, including the violence of the symptoms, will assist in forming a diagnosis. In Asiatic cholera the stage of collapse often sets in within a few hours from the commencement of the attack, but this is never the case in choleraic diarrhœa. Similarly in the early stage of choleraic diarrhœa there is seldom or never complete loss of voice or pulse, as often occurs in the virulent type of Asiatic cholera from the first.

Treatment.—In the case of infants the most advantageous plan of treatment consists in giving rest to the intestines. This is best effected by keeping the child as quiet as possible and giving him ice to suck, or a spoonful or two of cold water every hour for several hours. The child may after a time have milk and lime-water. A poultice made of half mustard and half wheat flour should also be applied over the abdomen. This will act beneficially in checking vomiting. If notwithstanding these measures relief is not obtained and vomiting continues, one or two grains of calomel or Hydrargyrum c. Creta may be given every hour. If after three or four doses the vomiting be checked while the purging continues, a drachm of castor-oil to be followed by astringents as acetate of lead or nitrate of silver should be tried. Tannin with diluted sulphuric acid may be given with advantage. Opium is very useful, but should be given in carefully regulated doses and mixed with brandy. The diet is all-essential; good milk mixed with lime-water is the most suitable for such cases, and occasionally a little brandy may be added.

In the case of adults, many patients get well without treatment.

Nematoda, and is otherwise known as whip-worms. In the human species it is known as *Trichocephalus dispar*. Of the round worms there are two kinds which infest man. These are common round worms, *Ascaris lumbricoides*, and margined round worms *Ascaris mystax*. This latter is a genuine human parasite and occurs in children. The males are about two inches in length, and the females four inches.

Ascaris lumbricoides.—These are extremely frequent in tropical places as in India, and also in the Mauritius. They infest the small intestines, but often migrate into other parts. They sometimes penetrate the intestinal walls and reach the peritoneum; they have been found in the gall-duct, thorax, and abdominal walls. They are found singly or in large numbers. Marshy and low-lying grounds are most productive of these worms, which in some parts of Holland, Sweden, and Portugal infest a large proportion of children. In length the male measures from four to eight inches and the female from nine to sixteen inches. Experiments with the ova have an important bearing on the question of sanitation and infection. An endemic of round worms has been traced to the use of drinking-water passing from a filthy stream. It would appear certain that the *A. lumbricoides* completes its cycle of life without passing through the body of any intermediate animal.

Characters.—Each worm resembles in shape an earth-worm. It is elongated, cylindrical, and tapering at either end; it is firm, elastic, greyish-red, or yellowish-white, transparent when recently voided, so that viscera can be seen through its parietes. The two sexes are in different animals, and placed posteriorly, the sexual opening being at the end of the anterior third; the male organ is in the shortly curved tail, which in the female is straighter and thicker; the vulva is seated at a constricted point of the body, and about one-third the distance from the head to the tail.

Symptoms.—These are the same as those resulting from the presence of thread-worms, but are more grave. The local irritation may lead to congestion, inflammation, erosions, and even slight ulceration of the mucous membrane of the intestines. When they migrate they set up additional symptoms of irritation in the affected organs. The constitutional symptoms are well marked among the weak and debilitated, and in young children. These are: derangements of the stomach and bowels; pain, or an uneasy sensation in the abdomen, chiefly confined to the umbilicus, and often attended with great thirst; itching of the nose, vomiting, and even fainting. The tongue is furred; there is variable appetite, offensive breath, and a peculiar hazy condition of the cornea; also irregularity of bowels, sometimes slight diarrhœa; there is also flatulence and distension of the abdomen. The reflex phenomena as due to cerebral disturbance, are general restlessness, convulsive twitchings during sleep, scratching at the anus, picking at the nose, grinding of the teeth, dull, frontal headache, squinting, dilated pupils, twitching of the limbs or violent convulsions, and a feeling of constriction in the throat. Added to these there are languor and depression of spirits and accelerated and irregular pulse. In severe cases enteritis and even perforation of the intestines occur. On the other hand, it often happens that little is known of the existence of these worms until some have passed. In children they give rise to symptoms of irritation, attended with fever and cerebral symptoms. Delirium and idiocy have been noticed in some cases.

Treatment.—This consists in adopting measures for the expulsion of the worm. This can be done by giving calomel, turpentine, santonine, mucuna pruriens (cowage), or powdered tin, to be followed within four hours by castor-oil. Santonine is the best remedy. It should be given in doses of two to four grains mixed with a little sugar, and followed in four hours by a dose of castor-oil. In large doses, santonine causes unpleasant symptoms, such as giddiness and impairment of vision. Kamala powder in doses of from one to two drachms for adults is also serviceable.

Oxyuris.—This kind of parasite is known as seat-worm or thread-worm (*Oxyuris vermicularis*).

Characters.—They differ in form and size from the ascarides proper, in that they are spindle-shaped and have a sharply pointed tail. They are small delicate worms, like a piece of cotton thread, from two to five lines in length, and whitish in colour; their surface presents transverse striæ. The sexes are represented by separate individuals, and the females are more numerous. Under the microscope the uterine ducts are found to contain numerous eggs. These in an advanced state of development contain perfect embryos, which soon acquire a perfect vermiform character. As a general rule, patients become infested with thread-worms by swallowing the ova, which are often adherent to fruit and other kinds of food. The embryos being liberated in the stomach pass into the intestines, where they undergo various changes, and finally arrive at their full maturity in the cæcum. These worms infest children more often than adults. They are mostly found in the cæcum, but often migrate into the rectum and escape externally, where they set up great irritation. Hundreds may be found in one subject. The worms themselves are doubtless often conveyed to the mouth on children's fingers and are afterwards swallowed, the ova forming a fresh source of infection.

Symptoms.—These are unpleasant sensations as heat, itching, and irritation at and around the anus. The worms often migrate, and there is itching of the prepuce or vulva, or, in children, of the nose. There are various sympathetic phenomena, as restlessness, nervousness, and great irritability, and sometimes chorea, convulsions, and epileptiform fits occur. The local irritation of the vulva may lead to hysteria or to profuse leucorrhœa.

Treatment.—Cleanliness is most essential in such cases. The symptoms are relieved by injections of solutions of salt or of perchloride of iron. In the case of children, calomel with compound scammony powder administered once or twice weekly for several weeks is often efficacious. A mixture containing iron and quassia should be given daily at the same time. As there is a tendency for recurrences, the treatment should be often repeated. In adults the results are far less satisfactory. A great many drugs are in use in such cases. Calomel, scammony, jalap, santonine, aloes, and even assafœtida are often given separately or together, followed by enemata of sulphuric ether, or quassia, or iron. Mineral waters are useful, especially after moderate doses of aloes and assafœtida. Diet is all-essential. All green vegetables should be avoided.

Trichocephalus is a genus of nematode worms. They are sometimes called long thread-worms or whip-worms. The thick body resembles the handle of a whip. In the human body the species is known as *Trichocephalus dispar.* This is one to two inches in length, and consists of a cylindrical body, thicker posteriorly than anteriorly, where it is hair-like, and ends in a terminal mouth. The sexes are in different individuals. The male is smaller, one inch in length, and has a spirally contorted tail; the female is thicker and larger, and is about two inches long. They are found mostly in the cæcum, and generally in small numbers.

Symptoms.—There is more or less intestinal irritation, constitutional disorder, and reflex disturbance.

The *treatment* is the same as that recommended for *Ascaris lumbricoides.*

Sclerostoma duodenale.—It is a genus of nematode worms. It is sometimes called *Strongylus quadridentatus.* It is rarely seen in India, though common in Egypt, where it gives rise to so-called "Egyptian chlorosis." The male is about four lines in length, the female being six.

Symptoms.—The presence of this kind of worm gives rise to extreme pallor of the skin and mucous membrane, great prostration, more or less dyspnœa, with palpitation and tendency to syncope. Very often dropsy sets in. Death may follow diarrhœa or dysentery. These symptoms are due to the loss of blood from the wounds

Symptoms. — Obstruction of the intestine is characterised by certain symptoms and physical signs. These vary with the cause, acuteness of the attack, and with the seat of obstruction.

(*a*) *Pain.*—This is the earliest and most constant symptom, and generally exhibits remissions and exacerbations. Sometimes, however, it is continuous and constant to the end. In impaction of a foreign body or gall-stone, at the commencement of intussusception and in strangulation occurring suddenly, the pain is acute and is often followed by faintness and even collapse. Strangulation as a result of twists gives rise to pain which comes on gradually but rapidly increases in severity. In cases of constriction the pain at the outset is slight. In compression due to tumours or displaced viscera, or by the impaction of fæces, there is little or no actual pain. As a rule such patients complain only of fulness, or discomfort. The *cause* and *character* of the pain vary according to the stages of obstruction. In the early stage, the cause of pain is the irritation of the mucous and serous coats of the portion of the intestine affected. In advanced cases the pain is associated with distension of the bowel, and is increased by the futile peristaltic efforts to move onwards the matter accumulated above the obstruction. In far advanced cases the pain is aggravated by the peritonitis and enteritis which supervene. In the early stage of strangulation and of impaction of gall-stones, the pain is increased by pressure on the diseased spot, but there is little or no general tenderness. In intussusception the pain is relieved by gentle pressure; it often causes great anxiety and distress.

(*b*) *Nausea and vomiting.*—In obstruction vomiting is a constant symptom. At the beginning it is generally sympathetic and due to shock. Where vomiting comes on later it is due to the regurgitation of the contents of the intestines into the stomach, or to reflex irritation due to injury or inflammation of the peritoneum. In cases of obstruction existing near the stomach early and constant vomiting is a marked symptom. In obstruction of the large intestine vomiting is delayed, and is not so prominent. Where the obstruction is in the upper part of the small intestine, but below the ductus communis choledochus, the vomited matter contains bile, and is but little offensive. In obstruction below the middle of the small intestine the vomited matter is fæculoid and very fœtid. When in the colon or lowest part of the ileum it may contain fæcal masses.

The regurgitation of the contents of the large into the small intestine is supposed to be due to great distension, rendering the ileocæcal valve inefficient. In health the contraction of the intestine on its contents presses them onwards; but in obstruction the con-

luria runs a chronic course. Large doses of gallic acid are said to be the best remedy.

3. *Tænia*, otherwise known as tape-worm. It constitutes a genus of cestode entozoa, and is characterised by the possession of a head with four sucking disks. Tæniæ present several varieties. In one there is a characteristic *head* or *scolex*, connected with a cyst or bladder-like body. They are devoid of sexual organs, and lie embedded in the solid tissues of the body. In another variety the worm or *strobilus* occupies the human alimentary canal. It presents at its upper end a head, by which it adheres to the mucous membrane of the intestine. Its body is tape-like, and divided into quadrilateral segments, each segment presenting a male and a female sexual organ, disposed along the lateral margins. Each segment contains a number of fertile eggs, which find their way into the alimentary canals of lower animals. After remaining in the intestines for some time they pass into the tissues of the body; the little hooks are then detached, and a neck and head, similar to those of the tape-worm, grow out from the wall. The parasites in this stage are known as cysticerci or bladder-worms, and are often found in pigs and sheep. When these parasites gain admission into the human intestines the bladder-like body drops off, segments are formed, and a tape-worm subsequently becomes developed. The most common species is the pork-tape-worm, *Tænia solium*; next in frequency comes the beef-tape-worm, *T. mediocanellata*, and mutton tape-worm, *T. tenella*, has also been met with. Tape-worms are most frequent in persons who indulge in pigs' flesh. They are common in butchers and cooks who are in the habit of eating raw beef.

Tænia solium is of a white colour, and flat in form. In length it varies from five to twenty feet. Its shape is uneven, being thick and broader behind. It is five or six lines at its widest part, and tapering at its anterior end. The body is distinctly jointed, and composed of numerous small segments broader than they are long. Each joint has a male and a female organ opening by an aperture externally. The head is blunt, square, bulbous, and has a snout, surrounded by a double row of hooks, and further back by four round symmetrically arranged suckers. The neck is about half an inch long. In the oldest links the ovary is filled with eggs, and the small embryos with their hooks may be recognised. The parasite infests the small intestine, and is fixed to the mucous membrane by hooklets. It is generally solitary, and remains for a long time before it is fully developed. A cystic representative of Tænia solium is *Cysticercus cellulosæ*. This variety is most abundant in pigs, and is the chief source of measly pork, and such pork if eaten leads to the development of Tænia solium in man.

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and the other in the rectum. The gaseous distension may be relieved by surgical interference. Puncturing the gut above the seat of obstruction has been found successful in some cases. Abdominal section and colotomy have been practised for internal strangulation and constrictions respectively, but the prospect after these operations is far from hopeful.

WORMS.

In common medical language the word "worm" implies certain parasites that inhabit the intestines. These parasites are found in three well-marked groups, known as (1) fluke-worms; (2) round worms, including thread-worms; and (3) tapeworms, including bladder-worms.

(1) *The fluke-worm.*—The word means flat or leaf-shaped. These worms are commonly spoken of as distoma. They infest the liver-ducts and gall-bladder, but have also been found in the subcutaneous tissue of various parts. Other species of fluke-worms known to infest mankind are the Egyptian hæmatozoon or ***Bilharzia hæmatobia.*** This parasite is very common in Egypt and in various parts of South Africa. It was first found by Dr. Bilharz, of Cairo, in the human portal system of vessels. It has also been found in the veins of the mesentery and bladder. The endemic hæmaturia of the Cape of Good Hope is due to the presence of this parasite. Various other kinds of fluke-worms have been found, but they are extremely rare.

Treatment.—In the case of distoma affecting the intestine, anthelmintics as santonine, male fern, &c., are of no avail. The best plan of treatment is to starve them out by putting the patient on milk diet. In the case of Bilharzia, vermicides are equally useless. In this disease it is essential to support the system by nourishing diet, tonics, and cold baths. Infusion of buchu with potash is the best remedy. Various other astringents, combined with hyoscyamus, are useful. It is very difficult to get rid of the parasites. The patients must be removed from the locality where they have contracted the disease. To prevent infection, the water of the infected districts should be boiled and filtered before being used for drinking purposes.

2. *Nematoda* or round worms. These entozoa more or less resemble earth-worms. Some are large lumbricoid parasites and infest man and several lower animals. There are three species. 1. Large round worms, otherwise known as *Ascaris lumbricoides.* 2. Thread-worms or seat-worms; these belong to another genus, known as *Oxyuris.* 3. *Trichocephalus* is the third genus of the

fern, in doses of from one to two drachms for adults. It is best given in emulsion flavoured with peppermint-water, and should be administered fasting, and be followed by a dose of castor-oil. Half-ounce doses of turpentine are also very efficacious; it should be given in an emulsion with castor-oil.

Bladder-worms.—These worms have the character of more or less transparent cysts or vesicles. The term embraces various parasites, as Cysticercus, Echinococcus, and Cœnurus, all larvæ of different species of tapeworm.

Cysticercus.—The word signifies a bladder and a tail. It is a bladder-worm furnished with a head, and is specifically identical with the pork-measle, othewise known as *Cysticercus cellulosæ*, with a slight difference in the number of hooks. The Cysticerci are chiefly found in the cortical substance of the cerebrum and in the eye.

In the case of the brain the symptoms, when present, may be serious, and consist of nervous disturbances, such as epileptiform seizures, mania, and imbecility, and other signs of irritation of the brain, or torpor of its functions.

These worms are supposed to live for about nine months, when they undergo calcareous degeneration and death. They invade other parts of the body. They are sometimes recognised in the subcutaneous and intermuscular connective tissue of the limbs.

Echinococcus.—This term includes several varieties of bladder-worms which infest human beings and animals. These worms are included in a class known as hydatids, which form a stage in the growth of a small tape-worm, which is found in the intestines of dogs and wolves. The word is now used to describe the scolices or heads of the future Tæniæ, which are developed from the internal membrane of the hydatid.

The word ***hydatid*** signifies a drop of water. It refers to a bladder-worm, which is the larval form of the *Tænia echinococcus.* The development of hydatids results from tape-worm eggs. The eggs may be swallowed either with food or drink which has been contaminated with the germs. Hydatids present various shapes according to the nature of the organ implicated. They present a thick investing capsule, formed of the tissues of the organ itself, and within this we find the walls of the cyst, which are two in number. The outer laminated portion is a thick, elastic, and homogeneous membrane, which, if removed, exhibits a peculiar tremulous motion. Within this there is an inner layer formed of delicate cells. This layer is made up of a thin, soft, non-elastic, and granulated membrane, and is the true or vital layer of the worm. It is from this membrane that the Echinococcus heads are formed. In some cases flatulence and distension of the abdomen. The reflex phenomena as due to cerebral disturbance, are general restlessness, convulsive twitchings during sleep, scratching at the anus, picking at the nose, grinding of the teeth, dull, frontal headache, squinting, dilated pupils, twitching of the limbs or violent convulsions, and a feeling of constriction in the throat. Added to these there are languor and depression of spirits and accelerated and irregular pulse. In severe cases enteritis and even perforation of the intestines occur. On the other hand, it often happens that little is known of the existence of these worms until some have passed. In children they give rise to symptoms of irritation, attended with fever and cerebral symptoms. Delirium and idiocy have been noticed in some cases.

Treatment.—This consists in adopting measures for the expulsion of the worm. This can be done by giving calomel, turpentine, santonine, mucuna pruriens (cowage), or powdered tin, to be followed within four hours by castor-oil. Santonine is the best remedy. It should be given in doses of two to four grains mixed with a little sugar, and followed in four hours by a dose of castor-oil. In large doses, santonine causes unpleasant symptoms, such as giddiness and impairment of vision. Kamala powder in doses of from one to two drachms for adults is also serviceable.

Oxyuris.—This kind of parasite is known as seat-worm or thread-worm (*Oxyuris vermicularis*).

Characters.—They differ in form and size from the ascarides proper, in that they are spindle-shaped and have a sharply pointed tail. They are small delicate worms, like a piece of cotton thread, from two to five lines in length, and whitish in colour; their surface presents transverse striæ. The sexes are represented by separate individuals, and the females are more numerous. Under the microscope the uterine ducts are found to contain numerous eggs. These in an advanced state of development contain perfect embryos, which soon acquire a perfect vermiform character. As a general rule, patients become infested with thread-worms by swallowing the ova, which are often adherent to fruit and other kinds of food. The embryos being liberated in the stomach pass into the intestines, where they undergo various changes, and finally arrive at their full maturity in the cæcum. These worms infest children more often than adults. They are mostly found in the cæcum, but often migrate into the rectum and escape externally, where they set up great irritation. Hundreds may be found in one subject. The worms themselves are doubtless often conveyed to the mouth on children's fingers and are afterwards swallowed, the ova forming a fresh source of infection.

owing to the pain, and marked irritability. In very severe cases delirium sets in, and the muscles of the limbs become flexed and paralysed. Diarrhœa continues till the patient becomes exhausted and helpless. This stage lasts about four or five weeks. If death takes place it is generally in the third or fourth week from inflammation of the bowels or of the lungs, or from general debility. Generally, however, if the patient is strong, the third stage, or that of recovery, sets in. The emigration of the worms is then complete, the fever ceases, the pulse lessens in frequency, the breathing improves, the temperature steadily becomes normal, and the appetite returns. In unfavorable cases this stage is one of collapse, and death may be due to syncope or various complications, as hæmoptysis, pneumonia, or hydrothorax.

Diagnosis.—Trichinosis may be mistaken for acute rheumatism, for enteric fever, and acute tuberculosis. The absence of pain in the joints, and the pain being confined to the muscles, exclude rheumatism. There is no rash of enteric fever, and no history of tubercles elsewhere. The trichinæ may sometimes be detected in the fæces and also in the muscles, when minute portions are removed.

Treatment.—It consists of attention to the urgent symptoms, and inflammatory complications. Diet is all-essential. If the patient be seen very early or before such injurious food has left the stomach, an emetic will be very useful. If the case be seen after a few hours a brisk purge repeated for two or three days will remove the worms. Calomel is the best purgative, but castor-oil or senna may be substituted. Ordinary vermifuges are useless. During the second stage, the indications are to lessen the fever, to relieve urgent symptoms, and to attend to the inflammatory complications. A good nourishing diet with stimulants is especially indicated. As a preventive, all meat should be well cooked. It has been asserted that the worms die at a temperature of 170° F., or, as some believe, at 150° F., if kept for some time at that temperature.

Filaria.—It belongs to the genus Nematoda and represents a variety of thread-like worms of uniform thickness throughout. These parasites are found in a variety of forms. 1. Dracunculus or Guinea-worm, otherwise known as *Filaria medinensis*. 2. *Filaria bronchialis*. 3. *Filaria sanguinis hominis*, a parasite which infests the blood.

Filaria medinensis (Dracunculus), or Guinea-worm.—It lives in the subcutaneous tissue, and is common in India. It is a female worm which enters the skin of man, and there becomes developed. It is cord-like in shape, varying in length from six inches to six feet, and about two lines in width. One or more may exist in the caused by the worms. Inspection of the fæces will reveal the presence of these worms or of their ova.

Treatment.—The chlorotic condition should be combated, and attention must be paid to diet and hygiene. The former should be nutritious, given in small quantities and repeatedly. Among the anthelmintics the ethereal extract of male fern is best adapted for these cases. As these worms live upon chyle and blood they should be effectively removed. In many cases one or two doses of male fern will suffice. Santonine has been known to succeed where the male fern has proved insufficient. Tonics of all kinds and wine are indicated.

Trichina.—It belongs to the genus Nematoda, and is a minute spiral flesh-worm known as *Trichina spiralis*. It is met with in the muscular tissue of men and animals. The male measures one-eighteenth of an inch and the female one-eighth of an inch in length. The entire course of development, from the period of impregnation to that of sexual maturity, is estimated to be about two or three weeks. In persons eating pork containing these germs in two days the muscle-larvæ maturate; the embryos are developed in six days, and the whole worm begins to migrate in fourteen days. The anterior end of the worm is pointed, the posterior thick and rounded. They are generally found enclosed in cysts in striped muscular fibres. They often live for years, and in many cases undergo calcareous degeneration. They are found in the flesh of pigs, which, when eaten, affects human beings. The cysts containing them become dissolved by the gastric juice, and the parasites are then set free. They there undergo development, and the living embryos then migrate from the intestinal canal into the small vessels and lymphatics of the bowels, and are thence conveyed by the blood to other parts. Their progress is very rapid.

Symptoms.—These vary in different cases. In ordinary cases, after taking trichinised meat insufficiently cooked, there are symptoms of indigestion, such as nausea and giddiness, followed by vomiting and fever. In bad cases diarrhœa sets in, and may last for many days. The fever is marked and the patient is prostrate. The muscles of the extremities become stiff and painful, and thus the first stage is complete. The second stage depends upon the migration of the worms. There is high fever, swelling of the face, difficulty of moving the muscles of the limbs, which are very painful and swollen, the eyes cannot be moved with ease, and there is intolerance of light. The tongue is very red and slightly coated. The pulse is very frequent—110 to 120 per minute. The muscles of deglutition and respiration are also affected, and the temperature often rises to 104° F. There is great sweating and sleeplessness

luria runs a chronic course. Large doses of gallic acid are said to be the best remedy.

3. *Tænia*, otherwise known as tape-worm. It constitutes a genus of cestode entozoa, and is characterised by the possession of a head with four sucking disks. Tæniæ present several varieties. In one there is a characteristic *head* or *scolex*, connected with a cyst or bladder-like body. They are devoid of sexual organs, and lie embedded in the solid tissues of the body. In another variety the worm or *strobilus* occupies the human alimentary canal. It presents at its upper end a head, by which it adheres to the mucous membrane of the intestine. Its body is tape-like, and divided into quadrilateral segments, each segment presenting a male and a female sexual organ, disposed along the lateral margins. Each segment contains a number of fertile eggs, which find their way into the alimentary canals of lower animals. After remaining in the intestines for some time they pass into the tissues of the body; the little hooks are then detached, and a neck and head, similar to those of the tape-worm, grow out from the wall. The parasites in this stage are known as cysticerci or bladder-worms, and are often found in pigs and sheep. When these parasites gain admission into the human intestines the bladder-like body drops off, segments are formed, and a tape-worm subsequently becomes developed. The most common species is the pork-tape-worm, *Tænia solium;* next in frequency comes the beef-tape-worm, *T. mediocanellata*, and mutton tape-worm, *T. tenella*, has also been met with. Tape-worms are most frequent in persons who indulge in pigs' flesh. They are common in butchers and cooks who are in the habit of eating raw beef.

Tænia solium is of a white colour, and flat in form. In length it varies from five to twenty feet. Its shape is uneven, being thick and broader behind. It is five or six lines at its widest part, and tapering at its anterior end. The body is distinctly jointed, and composed of numerous small segments broader than they are long. Each joint has a male and a female organ opening by an aperture externally. The head is blunt, square, bulbous, and has a snout, surrounded by a double row of hooks, and further back by four round symmetrically arranged suckers. The neck is about half an inch long. In the oldest links the ovary is filled with eggs, and the small embryos with their hooks may be recognised. The parasite infests the small intestine, and is fixed to the mucous membrane by hooklets. It is generally solitary, and remains for a long time before it is fully developed. A cystic representative of Tænia solium is *Cysticercus cellulosæ*. This variety is most abundant in pigs, and is the chief source of measly pork, and such pork if eaten leads to the development of Tænia solium in man.

same person. Their common seat is the lower limbs, but they can migrate to any part of the body. Those Indians who are in the habit of going barefooted in ponds or muddy places are most exposed to them. They have a period of incubation for months before they are developed to a perceptible size. Observations show that minute worms are often found lodged in the confervæ in tanks, and that persons bathing in such tanks become affected. Under the microscope the worm in the confervæ is found to be identical in form, colour, and general appearance with that extracted from the human body. The body is colourless, white, filled with granules, which are absent near the head, tail, and sides, where it is clear and transparent; it often presents a segmented appearance. The worms, as found in Bombay, are generally two feet four inches in length, and two to three lines in breadth. They bear in the centre of the anterior extremity a minute puncture and around it minute rugæ, external to which are two papillæ, one on each side opposite each other. The posterior end is suddenly inflected and is hard and rigid. Opinions differ as to the mode of development of this parasite, and also as to the manner in which it gains access to the human body. Some observers think that it passes through the skin, while others suppose that in some form or other it enters the stomach.

Symptoms.—The affection commences as a vesicle, from which, on bursting, the worm comes out. There is always considerable itching and irritation in the part, and often ulceration from scratching.

Treatment (preventive).—Persons should not be allowed to bathe in suspected tanks. The tank should be dried up and cleaned thoroughly, and lime should be thrown into it.

If the worm appear outside the skin it should be drawn out by gentle and continuous traction; the portion thus extracted should be wound round a piece of stick and kept *in sitû* for some time. A turn or two should be daily given to the stick, and this process should be repeated until the worm is wholly withdrawn.

Filaria sanguinis hominis.—This is a blood parasite (hæmatozoon), ordinarily found associated with chyloserous urine.

Characters.—The ova have no external covering or shell; the embryo is only enveloped by a delicate pellicle. Even though the embryo may attain maturity or worm-like proportions, the envelope is never lost so long as the worm remains in the blood. The average length of the parasite is $\frac{1}{75}$th of an inch; its breadth is about four times the diameter of a red blood-corpuscle. The filaria can be detected in the urine as well as in the blood. The urine has a milky aspect, and contains white and red corpuscles. Chy-

luria runs a chronic course. Large doses of gallic acid are said to be the best remedy.

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Tænia mediocanellata attains a very great length. The head is three times as thick as the body. It has no central papillæ nor any hooklets. The links are broader and thicker, and the sexual organs more fully developed. The head is furnished with four large round suckers. Its ova are oval. Its representative, the cysticercus, affects the ox, and the use of imperfectly cooked beef introduces it into the intestines of man.

Bothriocephalus latus, Tænia lata, or broad tapeworm.—Its length is very considerable; the head is obtuse, small, elongated, and without hooks or sucking disks. It has two lateral slit-shaped fossæ, one on each side. There is a single minute sexual opening on the posterior surface and in the middle of the links. It is flat and thin, and about six to ten lines in breadth, of a dirty white colour, and less opaque than the preceding. These are met with only in Europe, and chiefly in Switzerland. Their representative, cysticercus, is said to infest fish.

The *symptoms* caused by these worms vary both in character and degree. They may cause little or no inconvenience, while in other cases the suffering may be very great. Generally, however, a short time after the introduction of the worm into the body there are indications of loss of health, setting in with derangement of digestion. The patient soon grows anæmic, irritable, and restless at night; complains of headache, nausea, vertigo, and various other nervous symptoms, as dimness of sight, defective hearing, and noises in the ear. There is grinding of the teeth, irritation about the nose, and around the anus, and pains in the limbs. The patient often feels faint. Sympathetic phenomena as hysteria, chorea, and epileptiform convulsions may present themselves. Insanity and even mania have been caused by tapeworm. Amaurosis and squinting are also common complications. In a majority of cases improvement takes place after the expulsion of the worms.

Diagnosis.—This cannot be made with certainty unless fragments of the worm are passed from the bowels. The symptoms to which the parasites give rise are by no means of a distinctive character.

Prognosis.—Favorable, if under systematic management the worms can be expelled. In all cases of tape-worms it is necessary to see that the head is discharged, otherwise further growth will probably take place.

Treatment.—This consists in expelling the worms by some one or other of those medicines which are known as specifics. These drugs are kamala, kousso, turpentine, pomegranate-root bark, male fern, and areca nut. Various drastic purgatives, as calomel, jalap, scammony, &c., are also useful. Pumpkin seeds are very beneficial as an anthelmintic. On the whole the best remedy is the oil of male fern, in doses of from one to two drachms for adults. It is best given in emulsion flavoured with peppermint-water, and should be administered fasting, and be followed by a dose of castor-oil. Half-ounce doses of turpentine are also very efficacious; it should be given in an emulsion with castor-oil.

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Echinococcus.—This term includes several varieties of bladder-worms which infest human beings and animals. These worms are included in a class known as hydatids, which form a stage in the growth of a small tape-worm, which is found in the intestines of dogs and wolves. The word is now used to describe the scolices or heads of the future Tæniæ, which are developed from the internal membrane of the hydatid.

The word *hydatid* signifies a drop of water. It refers to a bladder-worm, which is the larval form of the *Tænia echinococcus.* The development of hydatids results from tape-worm eggs. The eggs may be swallowed either with food or drink which has been contaminated with the germs. Hydatids present various shapes according to the nature of the organ implicated. They present a thick investing capsule, formed of the tissues of the organ itself, and within this we find the walls of the cyst, which are two in number. The outer laminated portion is a thick, elastic, and homogeneous membrane, which, if removed, exhibits a peculiar tremulous motion. Within this there is an inner layer formed of delicate cells. This layer is made up of a thin, soft, non-elastic, and granulated membrane, and is the true or vital layer of the worm. It is from this membrane that the Echinococcus heads are formed. In some cases the hydatids only increase in size; in others they undergo further change, and form other cysts in the substance of their walls. Commonly they form brood-capsules containing numerous heads, which project into the general cavity of the mother-cyst. These secondary cysts present the characters of the parent cyst, but they are devoid of an outer laminated wall, and they contain scolices (heads) or echinococci. These small bladders or cysts are called acephalocysts. At other times, by a process of proliferation, the daughter and even granddaughter hydatids are formed within the original hydatid, and they, in their turn, produce echinococcus heads within them.

The fluid within the mother-sac or cyst is colourless and watery, of a specific gravity of 1008 to 1012, generally alkaline, occasionally acid, and contains excess of chloride of sodium. There is no albumen and no fibrin. Floating in this fluid are often found daughter-cysts, similar in structure to the mother-cyst. These secondary cysts often so completely fill the cavity as to show little or no fluid within the cyst. In some cases these daughter-cysts again contain within them other or their granddaughter-cysts, which again carry within them a fourth generation. When an acephalocyst is opened its lining membrane is seen covered with numerous opaque spots or granules, each of which consists of numerous *Tæniæ echinococci.* The Echinococcus is a round body, about one-tenth of a line in length; it has a depression at one extremity and an orifice at the other; at the depressed extremity it is attached to the parent cyst-wall. At the end of the canal lies a cylinder of hooklets surrounding the head, and on the sides are four suckers, which are moveable and close to the head.

Hydatid tumours may be single or multiple. They may be small and in one spot, or of an enormous size, so as completely to fill the abdomen. They are generally of a round shape. Hydatids are found in most countries. In Brussels, where dogs are employed for domestic purposes, the parasites are very common. In Iceland the disease is very prevalent, owing to the number of dogs and the habits of the people. Open natural waters of a place where dogs abound are apt to contain the germs. The disease also infects cattle who graze in places where the eggs have been dispersed by wind, or rain, and they in their turn communicate it to human beings. Of all the organs the liver is affected in about 50 per cent. of cases. The spleen stands next in order of frequency; and next come the lungs, kidneys, bladder, brain, and heart.

Treatment.—Ordinary vermifuges are of course useless. Surgical interference is sometimes efficacious, as, for example, in dealing with hydatids of the liver. Prophylaxis is all-important. With proper care, the disease could be stamped out.

DISEASES OF THE PERITONEUM.

PERITONITIS.

The peritoneum is an extensive serous membrane lining the abdominal and pelvic cavities, investing the viscera, and forming numerous folds and attachments with several organs and structures.

Peritonitis signifies inflammation of the peritoneum. It may be acute or chronic. In acute peritonitis there is at first capillary congestion followed by exudation of lymph, and in advanced cases by effusion of fluid. The disease has a tendency to spread till it involves the whole of the membrane.

Causes.—Peritonitis is more common among the poor and those enfeebled by bad health and bad living. It is also common in those who suffer from obstructive diseases of the heart, lungs, and liver, and from chronic Bright's disease. It may be induced by exposure to wet and cold, by propagation of inflammation from neighbouring parts, and by internal conditions to which inflammations of other organs are commonly traceable. When occurring during the puerperal state it is known as puerperal peritonitis. Traumatic peritonitis is due to some external injury to the abdomen, to hernia, or to perforation of the bowels. Peritonitis is often associated with tubercles in the abdomen, or cancer, or it may be a result of pyæmia, rarely of metastasis, or of rheumatism. In pleuritis of a septic nature, the inflammation is sometimes propagated through the diaphragm by means of the lymphatics between that muscle and the serous membrane. Another example of peritonitis by extension may be cited. In diseases of the uterus, the inflammation sometimes passes along the Fallopian tubes and sets up peritonitis. In traumatic cases various other causes often aid in setting up inflammation. Thus, if after an opening has been made into the peritoneum, it is left exposed to the air, or if the operation be done without the aid of antiseptics, or if, during or after the operation, septic matters or even blood be allowed to enter the peritoneal cavity, peritonitis will surely result. Penetrating wounds as those caused by a bullock's horn, and the rupture of the spleen or liver by direct violence, set up inflammation which is due to the escape of blood, or of the contents of the viscera into the peritoneal cavity. Sometimes peritonitis results from a mere contusion of the abdomen. Rupture of the peritoneum and consequent peritonitis are also due to other causes, such as rupture of cysts or other fluid accumulations; bursting of abscesses connected with the liver or kidneys or in the abdominal wall; bursting of an abdominal aneurysm or of a dilated receptaculum chyli. Fluid accumulations within the chest, such as empyema and abscess of the lungs, may perforate the diaphragm and set up peritonitis.

Peritonitis resulting from direct irritation may be general or local according as it affects the whole or part of the membrane. General peritonitis sets in as a result of over-distension of the abdomen in ascites, and it is associated with tubercles and cancer. Local peritonitis may result from pressure or friction on a portion of the peritoneum by intestinal accumulation, by cancerous or other tumours, by localised abscess or ulcer, or gangrene. It also results from strangulated hernia and intestinal obstruction, and irritation, as in dysentery and typhoid fever. Peritonitis is often secondary and may be a result of pyæmia or of some poisoned state of the blood. In Bright's disease, in septicæmia, in erysipelas, smallpox, and rarely in acute rheumatism secondary peritonitis sometimes occurs. In females the disease is more common than in males, and the difference is mainly due to the relations of the uterus with the peritoneum. The diseases of the uterus which affect the peritoneum are uterine congestion accompanying menstruation, the puerperal state, premature delivery, and local diseases of the uterus and its appendages.

With regard to the predisposing causes, age is an important point. Children seldom suffer from this disease, except where it is due to sloughing of the cord, or of the umbilicus in newborn babes, or to infection from the mother. In children tubercular disease and intussusception are causes of peritonitis. Chronic renal disease is a strong predisposing cause in adults.

Morbid appearances.—These for the most part resemble those found in inflammation of other serous membranes, but the morbid changes vary according to the nature, progress, and extent of the inflammation. In the early stage the membrane is highly vascular; the capillary vessels are enlarged and elongated, and the redness is most marked in places where the inflammation has begun, and also where the coils of intestine touch each other. Small extravasations of blood are often found scattered here and there. At first the membrane is dull-looking, dry, and velvety, from proliferation of tissue elements. The subserous tissue is thick and infiltrated. At a later period the increased vascularity may be wanting or obscured by the inflammatory products. These products vary in nature and amount. There is effusion of lymph, part of which coagulates on the surface, forming a false membrane; the rest and a more liquid portion accumulate in the cavity. In certain cases, known as adhesive peritonitis, the effused product is highly fibrinous, and contains organisable lymph, with very little serum. The lymph is of a yellowish-grey colour, and may be soft and easily separated, or hard, and form tough, elastic bands. The deposit varies in thickness, from a line or two to three or four lines. It forms a continuous layer, or is found in patches, and the coils of the intestines are matted together, either loosely or firmly. The coats of the intestines are the seat of collateral œdema. In a subsequent stage the appearances change, the lymph becomes organised, and partial thickenings and adhesions remain behind. In a few cases the effusion is more liquid, and when the quantity is very large it accumulates in the cavity and distends it. The exudation product may be pure serum, or serum and fibrin combined. In favorable cases the fluid portion becomes absorbed, and later on the solid parts disappear, after undergoing fatty metamorphosis. Partial thickenings and adhesions remain behind.

In many cases, where the inflammation is of a low type, the effused products undergo rapid disintegration, or they may consist of a soft and unorganisable greenish-yellow substance, infiltrated with pus-cells. The purulent fluid may be thin or thick, may be healthy-looking, or may be highly fœtid, or may contain more or less blood. Such an appearance is common in scurvy and low fevers. The pus gravitates towards the more dependent parts, as the pelvis. It may, however, become pent up by partial thickenings or bands of adhesions, and look like small abscesses ; the pus may be also found between the coils of intestines. Such cases are known as purulent peritonitis, and this condition sometimes becomes chronic.

With regard to the special changes in the membrane itself, the peritoneum and the subperitoneal tissue are often dull, swollen, soft, and œdematous. The subserous tissue is easily separable. Occasionally the tissues are infiltrated with pus. The contents of the peritoneal sac, as found on post-mortem examination, vary. There may be fœtid gas from decomposition of the inflammatory products, from transudation through the intestinal walls, or from perforation. In cases of peritonitis due to perforation the contents of the stomach or intestines, worms, bile, gall-stones, urine, &c., are found in the sac. The muscles of the abdomen are often soft in chronic cases. The intestines are distended with gas and protrude ; their walls are soft, œdematous, and infiltrated. In conducting a post-mortem examination great care is necessary, as the morbid products are highly virulent and infectious, and if introduced into the system will cause septicæmia. The infection is very liable to be conveyed to another, and hence, in attending puerperal cases, extreme care is necessary.

Symptoms.—These are local and general, and vary in different cases, with the (*a*) intensity, seat, extent, and course of the inflammation; (*b*) the constitution of the patient; (*c*) the cause or condition with which it is associated; and (*d*) the kind of inflammatory products. The local symptoms are due to inflammation and its products, and to its effects upon other structures in the neighbourhood. The inflammation at first sets up irritation of the muscular tissue, and subsequently leads to paralysis. The general symptoms refer to great constitutional disturbance and to febrile phenomena. They may also be due to the absorption of septic products. Other symptoms are those of collapse.

The disease sets in with severe local pain, which rapidly spreads over the abdomen. As a rule it is preceded by rigors, which are generally severe and repeated. In peritonitis due to perforation the rigors appear subsequently. Where the symptoms are insidious there may be for a few days only febrile phenomena or rigors. Sometimes there is sudden vomiting and purging or severe dysuria, and in females menorrhagia. Sooner or later the patient complains of pain and marked fever. The pain is most constant and characteristic, and is due to inflammation of the serous membrane. It is at first confined to the parts affected, but soon extends over the whole of the abdomen. It is very severe and agonising, causes much depression, and is increased by pressure or by any movement of the abdomen; coughing is very painful. The patient tries to keep the body perfectly still, and instinctively relieves the abdominal muscles by lying on the back, with the head and shoulders raised and the knees drawn up, and moves with his body bent in a stooping posture. The face presents an expression of suffering, the features are anxious-looking, drawn, and pinched. From time to time the pain exacerbates, owing to the coils of intestines rubbing against the inflamed peritoneum. There is actual prostration or much debility, and great uneasiness and restlessness. The abdominal respiratory movements are altogether suppressed on account of the pain and from paralysis of the diaphragm. The abdomen is very tender, and is also tense, hot, and tympanitic. The patient has a great dread of being touched; even the bedclothes are unendurable. The skin is burning hot and dry at first, but soon becomes cold and clammy. The temperature rises gradually to 100° or 101°, and may reach to 104° or 105°. It rises markedly at an early period, and continues high for a time, though without any regular course. The pulse is
r rapid, hard, and wiry or thready. It may be 140 or 150 in a
ite. There is derangement of the alimentary canal, the tongue

is red, slightly furred, and dry, the appetite is completely lost, and there is great thirst. Nausea and vomiting are very urgent and early symptoms, and occur either spontaneously or whenever any food is taken. There is generally obstinate constipation. The abdomen is tense and tympanitic; this is due to the distended state of the intestines from gases. The movements of the intestines are irregular, and they give rise to borborygmi. If inflammation extends to the bladder there is constant desire to urinate, and the urine is scanty and high-coloured, and contains urates. Sometimes there is retention. The urine is sometimes albuminous, and there may be jaundice. Other symptoms refer to the chest; thus, there is often hiccough, and also dyspnœa from compression of the lower lobes of the lungs. The respirations are shallow and superficial; there are about 40 or 50 in a minute. Peritonitis is sometimes associated with pleurisy, pneumonia, or pericarditis.

The examination of the abdomen should always be made with the utmost care and gentleness and various abnormal physical signs noted. These are due to (*a*) pain, (*b*) inflammation and its results, (*c*) foreign bodies in the sac of the peritoneum as a result of perforation or injury. The abdominal physical signs may be summed up as follows. *Inspection.*—There is at first slight depression due to the tension of the abdominal muscles, but after a time the abdomen is very much distended and the skin over it becomes tense and shining. The enlargement is generally symmetrical. The diaphragmatic respiratory movements are much lessened. During deep breathing a friction fremitus may occasionally be felt. The intestinal movements may often be felt and seen. The abdomen is smooth and presents a drumlike tension. Percussion yields a tympanitic sound, the sound varying in tone and pitch. The splenic and the hepatic dulness becomes less or completely inaudible. In the case of fluid, dulness may be noted varying with the posture, and may be elicited in the most dependent part. Succussion sounds are occasionally heard.

In peritonitis it rarely happens that the nervous system is prominently affected. The mind is clear to the last, and there are no cerebral symptoms except headache and sleeplessness. Occasionally there is low muttering delirium even at an early period.

Terminations.—Most cases of acute peritonitis end fatally within a few days. The symptoms are very often deceptive, the pain becomes less, and the fever abates, or the pain may suddenly disappear and the tympanites subside, yet the patient may soon grow worse and die. There is sometimes vomiting and purging of bloody fluid before death. Death sometimes occurs during high fever, but more often during collapse. The patient lies prostrate, the eyeballs appear sunken, the cheeks hollow, the face pinched, and the lips cyanotic. The abdomen becomes more distended; vomiting continues or even increases, and hiccough soon sets in. The temperature falls, the pulse becomes very feeble, very frequent, and irregular. The respirations are shallow and hurried, cold sweats cover the body, and the voice is weak or lost.

In chronic cases the termination is equally unfavorable. The abdomen becomes distended and ascites is said to result. The temperature generally remains high and the rise and fall are most irregular. The fluid collection may burst into the intestine or into the thorax; there may be septic poisoning of the whole system, or emaciation goes on, the fever wanes and waxes, and the patient dies in from four to six weeks from exhaustion.

Recovery in peritonitis is not very common. It takes place in cases where the inflammation is very limited or the inflammatory products consist of coagulable lymph. In such cases the severe symptoms gradually subside; the pain and fever abate; vomiting ceases; the respirations become natural; the temperature and pulse fall to a normal standard, the bowels are moved and the evacuations are natural. The urine increases in quantity and improves in quality. Sleep is restored, and the general condition of the patient improves; but although recovery takes place the effects of adhesions still remain and may prove serious.

Varieties: *Puerperal peritonitis.*—This form commonly occurs as a complication of puerperal fever. The morbid appearances are the same as in cases due to septicæmia. It usually runs a very rapid course, and is associated with pyæmia, taking its origin in inflammation of the uterine mucous membrane. It is often the result of contagion conveyed from a patient similarly affected. The disease is due to the fever-poison expending itself on the peritoneum. In a few hours or a few days after parturition peritonitis sets in with a well-marked rigor, followed by fever and intense pain in the lower part of the abdomen. At first the pain is confined to the peritoneal portion of the uterus; subsequently it extends to the whole abdomen. The patient lies with her thighs flexed upon the abdomen, which is swollen, very tender, and tympanitic. The bowels are confined. The pulse is very characteristic. It is generally quick, wiry, and incompressible. There is suppression of lochial discharge and frequent vomiting. If the inflammation extends to the bladder there is frequent micturition. If the disease extends, the abdomen becomes more distended and tender, vomiting increases, typhoid symptoms set in, and diarrhœa replaces constipation. The patient rapidly becomes collapsed and dies. In favorable cases the disease subsides; sometimes a chronic stage sets in and lasts a few weeks, after which absorption of the fluid with slow convalescence occurs.

Peritonitis from perforation is a most fatal disease, and may occur in persons who are apparently in good health. The ordinary causes of this condition are perforating ulcers of the stomach, rupture of the bladder, and perforating ulcers in the ileum, as in typhoid fever. In such cases irritating substances gain access into the peritoneal cavity. The symptoms of perforation are rigors followed by severe and sudden pain in a particular part, as if something gave way. There is extreme and immediate collapse, cold limbs, cold sweats, extremely feeble pulse, fainting, and severe vomiting. Many cases die within a few hours, and are sometimes mistaken for cholera; but in perforation patients die of collapse before the supervention of diarrhœa. Sometimes, however, patients rally somewhat from the shock, when the symptoms of local peritonitis and of fever become well marked, and, after a few hours or a day or two, collapse reappears, and death results. In typhoid fever, dysentery, and enteritis, peritonitis from perforation is not easily recognised, other abdominal symptoms masking its existence. Thus in typhoid fever perforation generally occurs in the second or the third week, when the patient is prostrate with diarrhœa, and is dull and insensible to all around him. There is no sudden collapse, and perforation is evidenced only by failing strength, increased feebleness and frequency of pulse, cold extremities, livid face, loss of power over limbs and sphincters, increased tympanites, and circumscribed tenderness in the abdomen.

Local peritonitis.—The affection often sets in in connection with some tumour in the abdomen. Thus in cancerous liver circumscribed peritonitis, attended with limited fibrinous effusion, is common. In such cases the pain and tenderness are circumscribed, and there may be friction-fremitus and friction-sound during respiratory movements. Other local and constitutional symptoms are absent. Uterine fibroids are also prone to set up local peritonitis.

There is yet another form of local peritonitis. The inflammatory effusion runs on to suppuration, or several multilocular abscesses form. In such cases the symptoms are pain and tenderness in a limited spot. After a time symptoms of an abscess appear externally. There is more or less fever, preceded by rigors. Such cases often end in general peritonitis; they may lead to perforation into the bowels, or pyæmia may occur. The fluid effusion may degenerate, may become caseous and absorbed, or may form thick bands or adhesions, and thus a cure is effected. In localised peritonitis the neighbouring organs also suffer.

Diagnosis.—Peritonitis sometimes resembles extreme and painful tympanites, as may occur in typhoid fever and erysipelas. The history of the case and symptoms characteristic of typhoid fever and erysipelas clear up the diagnosis. Other conditions resembling peritonitis are hysterical abdominal pain, pain of colic, of muscular rheumatism, and cutaneous hyperæsthesia; but in these there are none of the grave and marked symptoms, nor the peculiar pulse. In hysteria the cutaneous hyperæsthesia is generally associated with tympanitic distension of the abdomen, vomiting, and constipation, and there is a history of other peculiar symptoms. The tenderness is superficial, and firm pressure is borne without complaint when the attention is withdrawn. Peritonitis is often mistaken for painful affections of the abdomen, as cramps in the stomach, colicky pains, hepatic and renal colic, severe neuralgic pains affecting girls and women suffering from disorders of the generative organs. In these cases the pain and tenderness may be very severe, and may lead to collapse. The previous history, the mode of onset, the symptoms, and other characters, if carefully considered, will indicate the true nature of the case. Other morbid conditions in the abdomen for which peritonitis may be mistaken are enteritis due to intestinal obstruction, perforation of the bowels, inflammation of the cellular tissue round the cæcum, and perinephritis. The absence of constipation excludes enteritis. In intestinal obstruction vomiting soon becomes stercoraceous, and constipation is often sudden.

Prognosis.—The disease is often fatal, and is always serious. The progress is generally rapid, and death takes place within two or three days, or at most within a week. In rare cases the disease is prolonged to four or six weeks. The cases due to perforation, or to a septic poison, or to Bright's disease, are very grave. In young children and in patients already debilitated from any cause, the prognosis is very serious. The prospects are more hopeful when the disease is due to direct injury, or to some local irritation. The prognosis is also less serious where the disease is local and the inflammatory products are healthy. Where the disease lasts for a long time recovery is probable. In all cases the severity of the symptoms is a measure of the danger.

Treatment.—There is no one line of treatment to be adopted. The indications are (1) to attend to the cause, and if practicable remove it. If due to strangulated hernia the reduction by operation or otherwise will check further progress. If due to intestinal obstruction from accumulated fæces measures should be adopted to remove them; (2) the next main principle of treatment is to combat the inflammation so as to subdue or arrest it; (3) to influence its products, and to obviate their injurious effects upon the neighbouring organs; (4) to treat the urgent symptoms; (5) to support the strength. To procure rest for the affected part is most important. This can be best effected, in the early stage, by giving as little food as possible. Small quantities of iced milk may be given from time to time. Rectal alimentation is highly useful where the stomach is very irritable. If the patient be plethoric and strong, and the disease idiopathic, leeches may be applied to the abdomen or venesection practised. From twelve to twenty moderate-sized leeches will suffice. This measure is useful only in the early stage. Depletion should never be attempted if the patient is weak and the inflammatory symptoms are of a low type. Absolute rest must be enforced, and the weight of the bedclothes must be supported by a cradle placed over the abdomen. The patient is to be kept in a dark but well-ventilated room; opium should be freely given to quiet the peristaltic action of the bowels, and to procure sleep. It may be given by the mouth or by subcutaneous injection, and is the only remedy to save the patient's life. Calomel combined with opium, given every two or three hours till the system is affected, is sometimes used, but is not often serviceable. Opium is contraindicated if there is existing Bright's disease. In children opium must be given with great caution. Locally large linseed poultices, with laudanum or belladonna, may be advantageously applied to the abdomen, or their place may be taken by fomentations, turpentine stupes, or sinapisms. Some recommend the application of cold to the abdomen in the early stage. It is chiefly employed by means of iced-water compresses, frequently changed. The good results of cold are, it contracts the vessels, it lessens the irritability and intestinal disturbance, and relieves the pain. The sensations of the patient ought to be a guide in the choice of local applications of heat or cold. At a later period cold applications should be avoided.

To promote the absorption of the inflammatory products blisters may be applied to different parts of the abdomen. Where the fluid effusion is great the serum should be removed by a trocar.

With regard to the urgent symptoms of peritonitis, vomiting and dysuria must be relieved by suitable means. Directly the tendency to collapse or exhaustion sets in alcoholic stimulants must be freely given. Brandy and champagne are the best, and they should be given in small quantities and repeatedly. If the stomach is still irritable enemata containing brandy should be administered. Quinine, ether, musk, ammonia, cinchona, and turpentine are used from time to time as the urgency of the symptoms demands.

Chronic peritonitis.—This affection may be circumscribed or general. It is often a sequel of one or more attacks of acute peritonitis, and chiefly of the local form; and the chronic affection thus resulting sometimes merges into a general attack. Localised chronic peritonitis is a common result of continued irritation set up by some diseased condition of the abdominal viscera. Chronic peritonitis may also be referred to irritation due to accumulation of fæces, and to various morbid growths in the peritoneum, as tubercle and cancer. Thus chronic peritonitis is common in strumous children. It is also noticed during convalescence from fevers, and in those who are hereditarily predisposed to phthisis. It sometimes occurs as a result of repeated operations of paracentesis, and is occasionally associated with chronic Bright's disease and rheumatism.

Morbid appearances. — These vary with the seat, nature, and extent of the inflammation, but adhesions and thickenings constitute the chief morbid conditions. The thickening is due to the development of the inflammatory products into a fibrous or connective tissue supplied with new vessels. It varies from a line to an inch or more. It may spread round the abdominal organs, forming thick and firm capsules, and into the peritoneal folds. It often unites organs to each other, and also to the abdominal walls, or to the omentum or the mesentery. The inflammatory products also form effusions, which may be serous, sero-fibrinous, or puriform, and blood is often present. Circumscribed accumulations may open into the bowels or through the abdominal walls. In chronic peritonitis due to the presence of tubercles and other morbid formations, these are found in the peritoneum and the abdominal lymphatic glands. Such products may become caseous or cretaceous. The presence of tubercles may be due to infection from the purulent infiltration. The adhesions and thickenings lead to displacements and loss of mobility of various organs. Compression, constriction, intussusception and twisting of the bowels are occasional results. The omentum may be greatly distorted and the mesentery much shortened. These adhesions and thickenings sometimes prevent the escape of the contents.

Symptoms.—These are general and local. The general symptoms depend upon the condition with which chronic peritonitis is associated. In the case of tuberculosis, chronic peritonitis is characterised by symptoms which will be described in a special chapter. The local symptoms are due to the presence of inflammatory products; to the effects of these products upon the various organs and structures, and to the pressure exercised upon tubes, vessels, &c.

The onset may be insidious and gradual, or the condition may result from an acute attack of peritonitis. The symptoms due to adhesions consist of slight uneasiness and discomfort chiefly in the right iliac region, and the bowels are constipated. In well-marked cases the abdomen is tumid, tender, and painful, and there is a feeling of tightness or dragging. The pain is of a dull character, but occasionally severe and paroxysmal, and is increased on pressure and movements. Sometimes there is no pain, but only a feeling of soreness or heat. There is disturbance of the stomach and bowels, as indicated by furred tongue, great thirst, impairment of appetite, nausea, vomiting, and other dyspeptic symptoms. Constipation may be due to bands of adhesions which lead to intestinal obstruction. Sometimes in tubercular peritonitis diarrhœa supervenes, and assumes a dysenteric character. When the effusion is great the secretion of urine becomes diminished and the respiration is interfered with. The pressure of thickenings and effusion upon the abdominal organs and vessels may lead to ascites, œdema of the legs, jaundice, albuminuria, thrombosis, or neuralgic pains.

In some cases, even with considerable effusion, the general and local symptoms are very indefinite and there may be only uneasiness from fluid accumulation. The disease often runs a very unfavorable course; there is extreme emaciation and exhaustion, and bedsores form. Relapses are common. Comparative recovery may take place, the symptoms recurring from time to time.

Physical examination reveals many points of clinical interest, varying with the nature of the morbid conditions and the progress of the disease. There is enlargement of the abdomen, either uniform or irregular, and depending upon the amount of fluid, the quantity of gas in the intestine, and the solid exudation. In some cases the abdomen is retracted. On *palpation* there is a sensation of fluid within the abdomen either uniformly distributed or limited to circumscribed areas. In the latter case the accumulation may be surrounded by a hard or resisting area. Occasionally indurations in the form of bands or knots are observed. Morbid growths as tubercle, cancer, or organised inflammatory products may often be felt as firm, resisting, and irregularly nodulated bodies. In some cases transverse bands, stretching across the abdomen either horizontal or parallel to Poupart's ligament, are noticed. The tubercular lumps are generally superficial and hence distinguishable from the glandular growths, which are deep seated. On percussion at an advanced period tympanites and ascites are always present. The presence of fluid is indicated by dulness not varying with posture and movements, but most marked in front. Friction fremitus and friction-sounds may occasionally be felt and heard.

Diagnosis.—The disease may be recognised by attention to the history and by the signs and symptoms, but it may be mistaken for ascites. In doubtful cases the removal of the fluid will aid the diagnosis. In supposed tubercular peritonitis the age of the patient, the history of struma, the existence of tubercles in other organs, are the main points to be depended upon.

Prognosis.—This varies with the cause, progress, and extent of the disease, the nature and amount of the morbid products, and the effects upon the abdominal organs. The opening of purulent accumulations in various directions is likely to occur, and is of serious import. The existence of adhesions leads to various abnormalities in the condition of the abdominal viscera, and is therefore very unfavorable. The tubercular and cancerous forms of peritonitis are always grave.

Treatment.—The indications are general and local. Both aim at the absorption or removal of the inflammatory products, the improvement of the conditions upon which the disease depends, and the relief of the symptoms. To promote absorption the parts should be kept at perfect rest, and various counter-irritants, as iodine, should be applied. Other local remedies are mercurial ointment, frictions with anodyne liniments, and pressure by means of a flannel bandage. In cases of large effusion paracentesis may be performed. To remove inflammatory induration, iodide of potassium or the syrup of iodide of iron and diuretics are sometimes useful. Liquor Hydrargyri Perchloridi occasionally yields good results. The fluid accumulation may be lessened by diaphoretics, as hot air- or vapour-baths. Jaborandi or its alkaloid deserves a trial.

If the disease is due to tuberculosis the state of the general health requires special attention. Tonics of all kinds are indicated.

DROPSY OF THE PERITONEUM—HYDROPERITONEUM—ASCITES.

The word "ascites" literally means a leather bottle or a large belly. It implies a collection of serous fluid within the cavity of the peritoneum, the accumulation being of the nature of a local dropsy, and not originating in inflammation.

Causes.—Ascites is really a symptom, and is always a consequence of certain pre-existing organic diseases. It may be due to (*a*) direct mechanical obstruction affecting the portal circulation. The obstruction may affect (1) the trunk before it enters the liver, and may be external pressure or internal obstruction; (2) it may affect the branches of the vein within the liver; (3) it may affect the trunk of the hepatic vein or the inferior vena cava after it receives the hepatic vein. (*b*) Diseases of the kidneys, as Bright's disease. (*c*) Diseases of the heart and lungs obstructing the general venous circulation. (*d*) Morbid conditions of the peritoneum.

(*a*) *Mechanical obstruction.*—Any obstruction interfering with the portal circulation may give rise to congestion and over-distension of its tributaries. As a result the fluid portion of the blood is transuded into the peritoneal cavity, and sufficient absorption does not take place. In such cases ascites is a mere localised dropsy.

The portal trunk may be pressed upon by growths from the liver; enlarged absorbent glands; morbid growths, as cancer; aneurysm; or inflammatory products, as thickening, the result of perihepatitis. As a result the trunk may be completely closed, or a clot may form which obstructs the vessel. Various morbid conditions affecting the substance of the liver, as cirrhosis; syphilitic or other forms of contracted liver; indurations, as due to various degenerations and infiltrations, give rise to obstruction to the portal vein, and end in ascites.

The hepatic vein or the inferior vena cava is seldom obstructed, but such a condition may be caused by hepatic growths or other tumours.

(*b*) *Diseases of the kidneys.*—In such cases ascites is only a part of general dropsy, which often accompanies renal disease.

(*c*) In diseases of the *heart and lungs* there is congestion of the general venous circulation, and that of the liver is similarly affected. In such cases the ascites is generally preceded by anasarca in the lower extremities.

(*d*) *Morbid conditions of the peritoneum.*—Peritonitis gives rise to serous effusion, but this condition does not belong to ascites. Sometimes, however, local dropsy arises as a sequel of the inflammation. It is more often due to morbid growths of the peritoneum, as tubercles or cancer. Other morbid conditions are, active and mechanical congestion, obstruction of the lymphatic orifices and impaired absorption, and undue activity of the secretory structures.

Various other causes may be mentioned. These are exposure to cold, suppression of habitual discharges, exhausting diseases, extreme anæmia, and rapid disappearance of chronic skin disease. The disease may be met with at any age, but is most common in adults. In males ascites due to liver disease is the most common form. An anæmic state of the blood is very often associated with weakness of the tissues generally, and is a predisposing cause of ascites.

Pathology.—During health all closed cavities and areolar tissues of the body are kept moist by a continual serous exhalation, which is constantly being absorbed. In dropsy this balance is disturbed; either the exhalation is too much, or the absorption is deficient.

Characters of the fluid in ascites.—It is generally clear, transparent, watery or faintly yellow, and of alkaline reaction. In exceptional cases it may be turbid, dirty-looking, and mixed with fibrinous masses or coloured by blood or bile. Its quantity may vary from a few ounces to several gallons. It consists of much albumen and salts, traces of fibrine, bile elements, cholesterine, and in cases of renal dropsy, of urea.

Symptoms.—The disease sets in gradually and is chronic and progressive. The symptoms vary in different cases according to the cause, the amount of fluid accumulation, and the effects upon other parts. One group of symptoms is due to the mechanical effects of the fluid. Discomfort and uneasiness in the abdomen and a sensation of fulness are first complained of. The patient experiences a sense of fatigue and aching about the loins and in front of the abdomen. The fluid obstructs the circulation in the veins of the lower limbs, causing œdema. It impedes the movements of the diaphragm, and also interferes with the functions of the stomach and intestines, leading to constipation, or in some instances to diarrhœa or dysentery. There is also flatulence. The mechanical pressure of the fluid upon the stomach sometimes causes vomiting; the pressure upon the heart leads to palpitation, irregularity of the heart's action, and tendency to syncope. The heart is often displaced upwards, and to the left. Pressure upon the inferior vena cava leads to enlargement of the superficial veins of the abdomen, and to general anasarca of the legs; that upon the renal veins induces mechanical congestion of the kidneys with diminution of the quantity of urine and albuminuria. When the fluid is abundant, the patient walks like a pregnant woman with legs wide apart and head and shoulders thrown back. Its interference with the thoracic organs leads to collapse at the base of the lungs; the breathing is interfered with; it is chiefly upper costal, and there is a sense of dyspnœa, especially after taking food. The upper part of the body is much wasted, the face is anxious and pinched, and the general health deteriorated.

Physical examination of the abdomen.—When the quantity of fluid is large the skin of the abdomen appears tightly stretched, smooth, shiny, and thin; sometimes white lines are seen; the superficial veins are enlarged, those in the axilla are full and tortuous; the umbilicus is everted, stretched, or even obliterated; the belly is swollen and presents a general uniformly rounded enlargement, symmetrical in shape, when the patient stands or lies on his back. The form of the swelling alters with a change of posture, the fluid gravitating towards the most dependent parts. In contrast with this enlargement, the chest appears small and depressed; its lower margins are sometimes everted.

Palpation yields a sensation of tension of the walls, but no hardness beneath, and on *percussion* there is marked dulness over the seat of the fluid. The stomach and intestines float on the surface of the fluid, and hence the front is tympanitic or resonant. On placing one hand on one side of the abdomen, and tapping with the fingers of the other on the opposite side, a distinct fluctuation is felt by the hand. When the fluid is small in quantity there is no dulness in the recumbent posture, but it may in such cases be detected in front of the abdomen if the patient is placed on his hands and knees. It is always most apparent towards those regions to which the fluid gravitates. Thus, when the patient lies on his back the abdomen is tympanitic anteriorly, but the percussion is dull at first behind and in the flanks; gradually, as the fluid increases, there is dulness in the lower part of the abdomen. Thus the percussion note changes with the change of posture. As the fluid increases, the whole of the abdomen is dull except at the umbilicus, which region is often tympanitic. The line of demarcation between the dulness and tympanitic sound is well defined. When the patient sits up, the prominence between the recti muscles gives a tympanitic sound. In exceptional cases where the diagnosis is obscure, examination through the rectum at the anterior part reveals a feeling of resistance of the fluid in the recto-vesical pouch. The vagina is short, and the uterus is pushed considerably downwards or flexed. All these physical signs may be obscured under certain circumstances. When the fluid is small, it can hardly be detected; when very large, it occupies the whole abdomen; fluctuation is very indistinct and there may be dulness all over the swelling. The presence of adhesions or bands will render the diagnosis difficult. The sounds will be modified when new growths or enlarged liver or spleen coexist.

Diagnosis.—Abdominal dropsy may be mistaken for tumours or other abdominal diseases, and especially for ovarian dropsy. It will be distinguished from a distended bladder by passing a catheter. The enlargement in a female may be mistaken for pregnancy, but the history of the case and the application of the stethoscope to the abdomen will exclude doubt. Ascites has also to be distinguished from a flabby or relaxed state of the abdomen associated with flatulence; from fatty omentum, and from œdema of the abdominal walls. Among the rarer affections may be mentioned a dilated stomach, large hydatid growth in the liver, phantom tumour, and cystic disease of the kidney. The diagnosis must be based upon the history of the case and the physical examination already detailed. Where ascites coexists with enlarged liver or spleen, or any other morbid condition in the abdomen, great aid in the diagnosis can be obtained by paracentesis and further examination after the evacuation of the fluid. Three circumstances may render the diagnosis difficult. 1. The intestines may be tied down by the mesentery, so that an extremely small quantity of fluid will give dulness in the umbilical region. 2. An adherent omentum may strap down the intestines. 3. A previous tapping may have let air into an ovarian cyst. It is worthy of note that the general health is much affected in ascites, and but little in ovarian dropsy.

Other diagnostic differences are given in the subjoined table. It must, however, be remembered that ovarian tumour is sometimes complicated with ascites.

DIAGNOSTIC TABLE OF ASCITES AND OVARIAN DROPSY.

Ascites.	*Ovarian Dropsy.*
Dropsy is general or confined to the whole abdomen.	Begins on one side.
Abdomen broader than natural.	Abdomen not broad.
Appears at once or in a short time.	Only by degrees.
Is unsymmetrical; bulging of flanks; not adherent; fluctuation felt far beyond the limits of dulness.	Is more or less symmetrical, globular and adherent. Lines and limits of fluctuation and dulness correspond, and fluctuation sharp, quick, and distinct.
On percussion resonance above in standing posture, and at umbilicus while lying. Most dependent parts in any given position are dullest.	No resonance above or at umbilicus. Dependent parts not always dull.
Intestines rise above the fluid and to the surface, or under abdominal walls. Coils of intestines well marked.	Cyst rises in front of intestines.
Face pinched; upper part of body wasted; superficial veins over abdomen enlarged; skin shining.	Face often healthy. Skin shining only if swelling intense.
General dropsy often coexists.	No general dropsy.
Dyspnœa; scanty urine; anasarca of lower limbs.	Disordered menstruation; frequent micturition; œdema of thighs and legs.
Vaginal and rectal examination points only to resistance of the fluid.	Vaginal and rectal examination points to tumour on one side and uterus displaced.

Prognosis.—This depends upon the cause, the amount of fluid accumulated, the constitution of the patient, and the condition of the main organs, as the liver, kidneys, &c. If ascites is due to some organic disease it is generally dangerous; if the accumulated fluid presses upon the lungs and heart, and if there be disease of these organs, the case is extremely serious. When due to local interference with the portal circulation relief may generally be procured by medicine and surgical aid. If the local cause is curable the dropsy will disappear under suitable treatment.

Treatment.—The cause must be removed if practicable, and absorption of the effused fluid must be promoted. Thus, measures should be taken to increase the secretions from the skin, kidneys, and bowels. Hot vapour baths, Turkish baths, diaphoretics, diuretics, and purgatives are the principal remedies. Poultices of digitalis leaves over the abdomen are sometimes beneficial. Active purgatives are very useful, especially where dropsy is due to local causes, but must be given with caution. The purgatives in common use are jalap, scammony, elaterium, gamboge, podophyllin, croton oil, and calomel. For improving the general health and the state of the blood tonics and good food are especially indicated. The diet should be nutritious, simple, and easily digestible. When the accumulation is very great but little can be effected by medicines, and the operation of paracentesis may become necessary, and may prove curative (especially if repeated) in cases of ascites dependent upon cirrhosis of the liver. In cases of cardiac or renal dropsy the operation affords only temporary relief. When paracentesis is to be performed the patient is to be placed in the recumbent position on his side near the edge of the bed. The trocar with the cannula is introduced through the linea alba, midway between the umbilicus and the pubes. The abdomen should from the first be evenly and tightly bandaged. After the operation an equable pressure should be kept up for two or three weeks to promote absorption of the remaining fluid, and prevent further refilling. Immediately after the operation the patient feels comfortable owing to the withdrawal of the fluid. There is great tendency to reaccumulation. In such cases the operation may be repeated from time to time. The aspirator may be substituted for the trocar and cannula.

MORBID FORMATIONS AND NEW GROWTHS IN THE PERITONEUM.

These are of three kinds—deposit of fat, tubercle, and cancer. The fat is deposited in the subperitoneal tissue or between the peritoneal folds. This occurs in obese persons. The presence of an excess of fat interferes with the functions of the alimentary canal, and dyspepsia, flatulence, and constipation are the consequences. The abdomen appears much enlarged. Sometimes fatty tumours are connected with the peritoneum.

The next important morbid formation in connection with the peritoneum is tubercle. It may occur as an independent affection, or be due to tubercles in the intestines leading to ulcers, or it may be the result of acute tuberculosis. As an independent affection it pursues a chronic course, and is accompanied by various inflammatory changes. It is common in strumous children, and in adults between twenty and thirty years, and in those who are debilitated by excesses and are hereditarily predisposed to phthisis. It may occur as a result of repeated operations of paracentesis, and it is sometimes associated with chronic diseases of the liver, stomach, or intestine, and Bright's disease. As a primary disease it may exist alone as a result of infection from caseous glands, from products of chronic peritonitis, or from caseous deposits in the epididymis. The peritoneal deposit consists of both tubercular infiltration and miliary tubercles. The masses vary in size, from a small almond to a small egg, and are liable to undergo calcification or softening. The tubercles may also suppurate, and even rupture into the peritoneal cavity.

Morbid appearances.—Tubercular peritonitis is generally associated with tubercles in other parts, chiefly in the lungs. The tubercles often lead to effusion of lymph and presence of false membrane. Within or immediately beneath the peritoneum, or in the omentum, there are numerous miliary tubercles or granules; its anterior parietes are adherent to the subjacent structures. There is also deposit of lymph, which glues the coils of intestines together, and also covers the diaphragm, with the liver and spleen, the whole forming an inseparable mass. Most frequently the deposit is partial or limited to the vicinity of a single organ. The deposit may present scattered granules within the folds of the peritoneum, or may be thick, and the folds may be matted together by tubercular infiltration. In some cases the omentum is the chief seat of tubercles.

Besides the tubercles we also find redness of the serous membrane, effusion of fibrine or of dropsical fluid, and occasionally abscesses. The abdominal lymphatic glands, and more especially those in connection with the small intestines, are commonly tuberculous.

Symptoms.—These are obscure and vague, especially in cases here the disease is complicated with tuberculosis in other parts; hey are also obscure where the peritoneum is the sole seat of tuberculosis. Where the tubercles are chiefly confined to the peritoneum the symptoms resemble those of peritonitis and acute tuberculosis; in other cases they resemble those of chronic peritonitis. The *acute form* of tuberculosis is characterised by an indefinite period of lassitude, gradual loss of flesh and strength, followed by febrile phenomena. The abdomen is tumid, tender, and painful. There is disturbance of the stomach and bowels, and now and then paroxysmal attacks of pain or colic, more or less diarrhœa owing to intestinal ulceration, or constipation due to bands of inflammatory adhesions often leading to intestinal obstruction. In a few days typhoid symptoms are superadded, and the patient dies at the end of a few weeks.

In the *chronic form* the symptoms closely resemble those of chronic peritonitis. The disease may commence with symptoms of acute peritonitis, and then merge into those of a chronic form. In another class of cases the symptoms are insidious from the first. The effusion of fluid takes place, and ascites is very apt to ensue, with occasional jaundice and anasarca of the legs.

Duration.—The disease lasts for a few weeks or months, but it may be prolonged for a year or two.

Prognosis.—Tubercular peritonitis is, on the whole, a fatal disease.

Treatment.—This is the same as that of scrofula generally, and the treatment for peritonitis must be adopted when that condition is set up.

Malignant growths are extremely rare in the peritoneum, and are generally secondary, originating from extension, or appearing as a distinct but secondary disease. They generally occur after middle life, but may be met with in children.

The *scirrhus* is the most common form; it appears at first as hard spots scattered irregularly, but these soon coalesce and form large patches. The colloid cancer appears as a group of vesicles, and forms scattered growths. These have a tendency to spread on the surface, and to increase in depth; they involve the subperitoneal tissue, which becomes thick; they often extend to the muscular and mucous coat of the stomach and bowels. When extensive the great omentum becomes converted into a large lobulated mass, or becomes contracted, as in scirrhus, into an irregular transverse band. The *encephaloid* is a soft milky outgrowth, very rapid in its extension; it appears as small hemispherical nodules. These are more prominent than scirrhus, and rapidly invade the peritoneal folds, and also the subjacent organs. In some cases the whole of the peritoneum is found studded with small bunches of currant-like excrescences.

Symptoms.—The affection is generally associated with a similar disease of the neighbouring viscera, and hence the symptoms are of a mixed kind. There are signs of chronic peritonitis, with more or less effusion. Extensive hæmorrhage sometimes takes place, leading to anæmia and fainting. Other signs are disturbances of the abdominal organs, as nausea, vomiting, loss of appetite, constipation, or irregularity of bowels, and more or less pain in the abdomen. The abdominal organs are often implicated in the disease. In some cases ascites is present. There is general cancerous cachexia.

Diagnosis.—May be mistaken for an abscess, hydatid tumour, floating kidney, or an aneurysm. The presence of ascites or of subacute peritonitis, the implication of the gastro-hepatic omentum, and the obstruction of the portal veins, also of the common bile duct and consequent jaundice, and swelled feet, are the principal symptoms. Associated with these the existence of a tumour in the abdomen and its rapid enlargement are characteristic. The tumour may occupy any region, may be fixed or moveable, hard or soft, and fluctuating, and when over any vessel may even pulsate.

Prognosis.—The disease is necessarily fatal.

Treatment.—It is only palliative. The urgent symptoms may be attended to and pain relieved by opiates. The patient should be supported by nutritious diet and stimulants.

DISEASES OF THE DIAPHRAGM.

The diaphragm is the seat of various disorders, both functional and organic. It may also be affected by extension of neighbouring morbid conditions.

Various diseases of the chest and abdomen frequently interfere with the normal action of the diaphragm; it may be displaced downwards or upwards or rendered tense and stretched. The whole of the diaphragm or only a portion of it may be affected. Thus the action of one half of the muscle may be interfered with or that of its central part. Various morbid conditions of the chest affecting the diaphragm are pleuritic effusions, pneumothorax, emphysema of the lungs, pericardial effusion, enlarged heart, and tumours in the chest. Those connected with the abdomen are distended stomach, flatulence or tympanites, ascites, peritonitis, pregnancy, enlargements of the liver, spleen, or of any other abdominal viscera, and various tumours as ovarian, hepatic, splenic, or renal. In cases of extensive and superficial burns of the skin of the chest and abdomen the diaphragm becomes affected and the breathing is abdominal.

In all these cases the respiration is much hurried or oppressed and laboured, the normal relation between the abdominal and thoracic movements is altered, the diaphragm acts in such a way that the lower part of the chest wall is drawn in during inspiration, and the act of respiration is more or less impeded. The patient often complains of a sense of tightness and a feeling of discomfort in the lower part of the chest.

The functional disorders of the diaphragm include paralysis and spasm.

Paralysis.—It may be due to diseases or injury of the upper part of the spinal cord. When the phrenic nerves are diseased or cut, or destroyed, or even severely compressed, paralysis follows. The paralysis may affect one side or the other, or the whole of the diaphragm, according as the one or both of the phrenic nerves are involved. Paralysis of the whole of the diaphragm is generally sudden, and death is due to the stoppage of the respiratory functions. Where the paralysis sets in slowly affecting the whole or only a part of the diaphragm, the act of respiration is very much interfered with. The patient complains of dyspnœa and of a want of power to breathe; the respirations are hurried, shallow, and confined to the upper part of the chest. The acts of coughing and of expectorating as well as those of defæcation and vomiting, which require a tense diaphragm, cannot be properly performed. The lower portions of the lungs become more and more congested, and death results by asphyxia, due to the accumulation of fluids in the air passages.

Spasm of the diaphragm may be either clonic or tonic. The spasm may be due to disease of the nerve-centre at the origin of the phrenic nerves, to irritation of these nerves during their distribution or in their course; to direct irritation of the diaphragm, and to reflex causes. Tonic spasm is observed in cases of strychnia poisoning, in tetanus and hydrophobia. In such cases there is severe pain and a sense of constriction in the corresponding region, coming on in paroxysms. There is also hiccough; respiration is interfered with, and the patient becomes suffocated and dies. In the spasm of the diaphragm which occurs in asthma, expiration is very difficult and prolonged and inspiration short and abrupt. The patient shows signs of great distress and of impending suffocation.

Organic lesions.—These are perforation and rupture. Rupture of the diaphragm occurs in connection with injury or accidents, or as a result of the bursting of an abscess. Thus in cases of empyæma, hepatic abscess, and hydatid cysts, the fluid sometimes bursts through the diaphragm. The progress of an aneurysm or of a cancer may, by destroying its structure, lead to perforation. When due to the breaking through of a fluid accumulation, the contents escape either from the abdomen into the chest, or from the lungs or pleuræ into the abdomen. In rare instances diaphragmatic hernia results and is due to some portion of the thoracic or abdominal organs passing through the perforation.

Perforation of the diaphragm can be recognised only by signs indicating that its functions are more or less impeded. The previous history of any of those conditions which are likely to cause perforation will aid the diagnosis. When perforation occurs, there is a sudden and severe pain as if something gave way, followed by shock or symptoms of collapse. The signs of the original lesion disappear and symptoms of pleuritis or of peritonitis take their place.

Inflammation of the diaphragm.—The serous covering of the diaphragm on either its thoracic or abdominal aspect is often involved in inflammation. In acute pleurisy, in pericarditis, and peritonitis, inflammation soon extends to the diaphragm. Inflammation of the substance of the diaphragm may arise from injury or direct irritation or may be due to pyæmia.

Post-mortem appearances. — There is increased vascularity, its surface is covered with lymph, the muscular tissue is soft and degenerated; in rare cases abscesses form in the substance of the diaphragm. In chronic cases fibroid changes take place in its muscular tissue.

Symptoms.—In acute cases, the symptoms are obscure. Generally, however, there is severe pain in the region of the diaphragm, increased on pressure, deep inspiration, coughing, and defæcation. The respiration is thoracic, hurried, and shallow. The patient is very much distressed and there is more or less fever. If an abscess forms, it may open into the peritoneum or the pleura and give rise to symptoms of pleuritis or peritonitis.

Degenerations.—The diaphragm, like any other muscle of the body, is subject to atrophy and degeneration. In progressive muscular atrophy, in general wasting as occurs in old people, atrophy of this muscle sometimes takes place. Degeneration may also be the result of chronic inflammation of the diaphragm, or of want of action, or of want of proper blood-supply. Vascular degeneration also leads to it. In such cases the action of the diaphragm is impeded; there is no pain, but only a sense of discomfort.

Morbid growths.—Malignant growth is extremely rare; when it occurs it is usually secondary to cancer affecting the neighbouring structures. Non-malignant solid growths are very rarely seen affecting the diaphragm. Parasites and tubercles are occasionally found in it.

Treatment.—In diseases of the diaphragm treatment is of little avail. In any case attempts must be made to get rid, as far as possible, of those conditions which interfere with the respiratory movements, and prevent the diaphragm from performing its function. The pain and discomfort may in part be relieved by warm applications with opium or belladonna. If there be suspicion of inflammation leeches should be applied. Electricity has been employed in cases of spasm and paralysis. Where the induced current fails, the continuous current should be tried.

DISEASES OF THE LIVER.

Diseases of the liver form a numerous and important class of disorders, and are constantly met with in practice. Like diseases of other organs, they are divisible into two main classes, viz. functional and organic.

Functional disorders include jaundice due to derangement and suppression of bile, and various other affections which influence the secretion of this fluid. The organic hepatic diseases are classified as congestion or hyperæmia, inflammation and its results (acute and chronic), hypertrophy, atrophy, degeneration and metamorphoses (fatty and albuminoid), morbid formations, as syphilitic growths, cancer, tubercles, and hydatids. Other affections are biliary accumulations and hepatic malformations and malpositions.

Before describing in detail the various hepatic disorders it is convenient to take a general survey of their etiology and clinical features.

Causes.—The most important causes are (1) constitutional or general disorder, as syphilis, tubercle, cancer, and albuminoid disease; any one of these disorders may give rise to affections of the liver; (2) injury or wounds; (3) any irritation by a foreign body, as biliary calculi or worms (*Tænia echinococcus*); (4) irregularities in diet, constant use of rich animal food, and abuse of alcohol produce disorders of the stomach and bowels, and affect the liver through the medium of the portal circulation; (5) long-continued exposure to a high temperature, especially if moisture be also present, is a fertile source of hepatic disorders; (6) extension of disease from neighbouring structures, and the transference of morbid materials, as from the intestines, are occasional causes; (7) hepatic affections often occur in connection with obstructive cardiac diseases.

Clinical features.—Diseases of the liver give rise to (1) morbid sensations, varying from discomfort to feelings of weight, throbbing, or pain, with or without tenderness, both in the hepatic region and also in the right shoulder; (2) changes in the quantity and quality of bile, jaundice, and other accompanying phenomena; (3) more or less obstruction to the portal circulation and congestion of the portal veins, with, as possible consequences, derangement of the stomach and bowels, hæmorrhage from these parts, ascites, enlargement of the spleen, and occasionally hæmorrhoids; (4) in enlargement of the liver the pressure upon the diaphragm, lungs, vena cava, and duodenum gives rise to dyspnœa and other symptoms.

Physical signs of hepatic diseases.—These are enlargement or contraction of the liver, changes in its situation, consistence, shape, and form. Other symptoms, as fever, general wasting, and disorders of the alimentary canal are often met with.

Symptoms in detail.—Certain symptoms require a more extended notice. Enlargement of the liver may be painful or painless. The surface of the organ may be smooth or irregular. An increase downwards of the hepatic resistance may be produced without true enlargement by several normal conditions. Thus during health the dulness varies; the liver is larger in early life than in adults, and it does not grow in proportion to the rest of the body. It is depressed in inspiration, and ascends in expiration. It is lower down in the erect than in the recumbent posture. During digestion it is temporarily enlarged. In persons with pigeon-breasted chests the organ is depressed and elongated vertically. A similar condition results from tight lacing. In malposition the size of the liver varies. It is pressed downwards, or its increase upwards may be simulated in pleural effusions or solid lung, in pneumothorax, in emphysema of the right lung, in thoracic tumours, in extreme pericardial effusion and dilated heart. In ascites, ovarian tumour, and in cases of abdominal aortic aneurysm it is pushed upwards. In flatulent distension the intestines may get in front of the anterior border of the liver, and thus cause diminished dulness. Rigidity of the right rectus may simulate enlargement of the liver. In disease the enlargement may be due to hyperæmia, catarrh of bile ducts, obstruction of common duct, and retention of bile; to hepatic abscess, cirrhosis, or cancer, or to simple hypertrophy; to amyloid or fatty degeneration, or hydatids.

Physical examination of an enlarged liver.—This reveals increased area in front, either upwards or downwards, or in both directions. The organ feels massive and dense as compared with mere displacement. Its edges feel sharp or round, even or uneven, hard or soft. The surface feels smooth and even or uneven. The enlargement may be general or local.

Inspection.—In enlargement we notice a bulging close to the lower borders of the right ribs. The enlargement usually follows respiratory movements. On *palpation* the organ is somewhat moveable. *Percussion* denotes increase in extent and character of dulness, with considerable sense of resistance. However irregular the surface, the usual outline can be traced. The ordinary extent of dulness can be traced in a curved line upwards, and between the fifth and sixth ribs. It is four inches in the right mammary line, five inches in the right axillary line, four inches in the right dorsal line, and three or four inches in the median line anteriorly. The with the secretion of bile. Thus in chlorosis the surface has a greenish-yellow colour. A similar yellowish condition of the skin is also noticed in cases of cancer in which the liver is not attacked. Newborn children sometimes have a yellow hue of skin a few days after birth. In Addison's disease a similar colour exists. Exposure to malaria, lead-poisoning, and anæmia due to chronic structural diseases of any organ sometimes produce a yellowish hue of the surface. All these spurious discolourations can be readily diagnosed from true jaundice.

As a symptom jaundice presents many clinical phenomena. As already remarked there is discolouration of the tissues of the body, the skin and conjunctivæ in particular. There is also discolouration of the secretions as the saliva, urine, and sweat. The fluid of blisters is often found of a yellow colour.

Discolouration of the skin.—In obstruction to the passage of bile through the common duct, discolouration of the conjunctivæ first appears within twenty-four hours. The skin is next affected; a certain concentration of the bile pigment is necessary for the discolouration to be manifested on the skin. The amount of discolouration varies with the cause, and the course the disease may take. It may be pale sulphur, or deep yellow; sometimes, as in black jaundice, it is deep olive or bronze colour. In cases of obstruction it is light at first and gradually becomes deeper if the obstruction increases, and lighter if it becomes less. In advanced cases the colour may become paler owing to the destruction of the liver tissue and to the small quantity of bile which is secreted. In obstructive jaundice the discolouration also varies with the quantity of bile secreted and the quantity of urine passed. The deep olive hue of the skin as a result of obstructive jaundice may be seen in cancer or gall-stones. In black jaundice the blood is highly deteriorated, and the discolouration is owing to the bile pigment being vitiated and dark, and also to the imperfect arterialization of the blood causing lividity of the surface of the body. Where jaundice is due to causes other than impediments to the flow of bile, the discolouration is slight, but the symptom is always of a serious import. The colour of the skin also varies with the age, with the amount of subcutaneous fat, and the complexion. It also varies from day to day with the activity of the skin and kidneys.

The secretions.—Besides the secretions from the skin and kidneys, others, as the saliva and tears, are sometimes tinged with bile. The secretions from the mucous surfaces, of the respiratory passages, and of the alimentary canal are generally unstained. The sweat glands sometimes secrete perspiration of a yellow colour, so as to stain the bedclothes.

The lithic acid is eliminated by the kidneys, and thus the morbid phenomena are averted. In strong and robust persons, from any irregularity of diet, and in gouty persons, the urine often contains excess of lithic acid, lithates, and pigmentary matter. In many cases the lithic acid and lithates accumulate till at last they give rise to most distressing symptoms. Of these the most characteristic are loss of appetite, coated tongue, fœtid breath, unpleasant taste in the mouth, oppression at the epigastrium, distension of the stomach and bowels, acid eructations, sense of weariness and drowsiness after food, constipation, and vitiated state of the urine, saliva, &c. Various nervous phenomena, as frontal headache, giddiness, irritability of temper, restlessness, and noises in the ears are frequently present. There is often palpitation of the heart and irregular pulse. Where the lithates are retained in the system such patients sooner or later become gouty. They are also apt to suffer from biliary and urinary calculi. They are also predisposed to various local inflammations under the operation of trivial causes. In such cases, when an ordinary febrile catarrh sets in, the elimination of the lithic acid and of lithates by the kidneys ceases, and their discharge becomes re-established with the subsidence of the catarrh or local inflammation. Other results of lithæmia are various cutaneous eruptions, as eczema, psoriasis, lichen, and urticaria.

3. *Disordered secretion of bile.*—Like every other secreting gland, the liver extracts from the blood those materials which it requires. The bile is destined for several uses in the economy after it leaves the liver. A fair portion of it is reabsorbed, and it greatly assists the pancreatic fluid in the saponification, absorption, and assimilation of fats. It has no action upon albuminoids, but slight assimilative action upon starchy food. The remaining portion of the bile passes onwards into the intestinal canal, where it acts as a stimulus to the intestinal gland follicles and promotes their secretion. It also promotes the peristaltic action of the bowels, and arrests decomposition of the food during its passage through the intestine. In hot climates, where the oxidation of only a small quantity of carbon and hydrogen is required to sustain the animal heat, the remainder of the carbon is separated from the blood by the liver, which is therefore more active and more liable to disease than in cold regions. The bile which is not immediately required for digestive purposes is accumulated in a pear-shaped reservoir called the gall-bladder. In it the bile is of a dark colour, thick, and ropy, owing to concentration and to its admixture with mucus. When retained beyond a certain time it becomes more stimulating or acrid. The bile is secreted from the portal blood, and its quantity varies in proportion to the amount required for the purposes of assi-

irregularity. It occurs especially in phthisis pulmonalis and wasting diseases. The surface is smooth, of soft consistence; there is no pain, no jaundice, no portal congestion, no enlargement of spleen, no ascites. There is albuminuria and general development of fat in the body.

FUNCTIONAL DISORDERS OF THE LIVER.

According to recent observations the liver has three distinct offices to perform. 1. The formation of glycogen. 2. The depurative action or the metabolic function; and 3. The secretion of bile. Functional derangements of the liver present certain phenomena, which may be arranged under several heads: 1. Abnormal nutrition. 2. Abnormal elimination. 3. Abnormal disintegration. 4. Derangements of the various systems of the body. 5. Derangements of the functions of the skin.

Causes.—Functional hepatic disorders are, as a rule, secondary to structural changes in the liver, or to diseases of the heart or lungs, or of the abdominal viscera. They are also secondary to malaria and febrile affections. When primary they are often due to errors in diet and excessive use of alcohol. Deficient exercise induces hepatic disorders. Living in a high temperature, as within the tropics or in warm rooms, is another cause. Various depressing influences play a certain part in the production of liver disease.

1. *Disorders of the glycogenic functions.*—During health the formation of glycogen—a substance allied to grape sugar—is constantly taking place in the healthy liver. After it is once formed it becomes converted into sugar or glucose. This substance, in a healthy state of body, is used up in the circulation as a combustible or oxidisable agent.

In disease the proportion of the sugar produced and the sugar destroyed varies considerably. Thus there may be either an overproduction or a diminished consumption. The excess of sugar in the blood passes off by way of the kidneys, and the disorder known as diabetes results.

2. *Depurative action or metabolic function.*—This is evinced by destructive metamorphosis or disintegration of the albuminoids in the blood. These are converted into urea, which is eliminated by the kidneys. Some assert that the liver is also the chief source of uric acid. In disorders of the liver we often find a deposit of uric acid in the urine.

When the nitrogenous matters, from some cause or other, are not converted into urea the result is the formation of lithates or lithic acid in the blood. This morbid condition is known as lithæmia.

The lithic acid is eliminated by the kidneys, and thus the morbid phenomena are averted. In strong and robust persons, from any irregularity of diet, and in gouty persons, the urine often contains excess of lithic acid, lithates, and pigmentary matter. In many cases the lithic acid and lithates accumulate till at last they give rise to most distressing symptoms. Of these the most characteristic are loss of appetite, coated tongue, fœtid breath, unpleasant taste in the mouth, oppression at the epigastrium, distension of the stomach and bowels, acid eructations, sense of weariness and drowsiness after food, constipation, and vitiated state of the urine, saliva, &c. Various nervous phenomena, as frontal headache, giddiness, irritability of temper, restlessness, and noises in the ears are frequently present. There is often palpitation of the heart and irregular pulse. Where the lithates are retained in the system such patients sooner or later become gouty. They are also apt to suffer from biliary and urinary calculi. They are also predisposed to various local inflammations under the operation of trivial causes. In such cases, when an ordinary febrile catarrh sets in, the elimination of the lithic acid and of lithates by the kidneys ceases, and their discharge becomes re-established with the subsidence of the catarrh or local inflammation. Other results of lithæmia are various cutaneous eruptions, as eczema, psoriasis, lichen, and urticaria.

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milation; and the secretion ceases altogether if the portal vein is tied.

The flow of bile is said to be continuous. It is increased an hour or two after taking food, and continues till the digestion is completed. About forty or fifty ounces are secreted in twenty-four hours. In cases of obstructive jaundice, where most of the bile is reabsorbed, the blood is found rich in fat and soda. In cases of gall-stones obstructing the common duct, the patient rapidly loses fat. In cases where the liver continues to be inert, or acts inefficiently the bile is not properly secreted, but the intestines by a kind of vicarious action supply a fluid resembling bile. A similar vicarious excretion of urine is known to occur when the function of the kidneys is suppressed. Where bile is prevented from reaching its proper destination it becomes a source of irritation and mischief; thus, in jaundice, the constituents of bile display themselves in every tissue and fluid of the body.

Advantage is taken of the fact of this vicarious elimination of bile from the intestine in cases of portal congestion where the liver is presumably inactive. A dose of calomel or other cholagogue is given to relieve constipation in one person and to check diarrhœa in another; under its use, the motions which were formerly colourless become more or less green, or sometimes when seen by reflected light they appear black. This change in the colour of the fæces is partly owing to the discharge of the bile which was probably long retained in the gall-bladder. In tropical countries a temporary suspension of the functions of the liver and the consequent absence of bile in the fæces are common causes of irritation of different portions of the intestine, producing or aiding in the production of different diseases as diarrhœa, dysentery, and cholera.

Disorders of the biliary function.—The secretion of bile may be deranged in two ways; there may be either excessive or defective secretion. In cases of insufficiency the secretion is defective or even altogether suspended; and besides this the bile may be properly secreted by the liver, but may be retained in the bile passages. In both cases the normal quantity of bile is prevented from flowing into the intestine. The bile elements are partly retained in the portal system and partly carried by the hepatic veins into the general circulation. In that form of jaundice in which the function of the liver is altogether suspended (owing to malaria), the elements of bile are retained in the portal system, and a severe form of enteric derangement is the consequence. In obstructive jaundice the bile, although properly formed, is prevented from passing into the intestine, and it enters the general circulation whence it is taken up by various tissues and excretions. In such cases the kidneys often remove from the blood those materials which otherwise would have formed bile. Both forms of jaundice resemble each other in the discolouration they produce. Another semblance is to be found in the condition of the alvine evacuations. The colour of the stools is supposed to afford a tolerable estimate of the state of the function of the liver, but this in reality is not always the case. The colourless evacuations do not always justify the supposition that bile is absent, or that there is little or none secreted by the liver; nor in the so-called bilious diarrhœa do we always find that the bile is in excess or over-secreted.

Excessive secretion.—The term bilious is erroneously employed to designate various conditions in which there is excessive formation of bile. Bilious fever implies a febrile condition attended with yellowness of the skin. Dyspepsia and its attendant hemicrania are known as biliousness. The secretion of bile is increased by rich food, strong spirits, and spices, also by indolence and by heat, and also during hepatic congestion. Excess of bile in the system is known by slight febrile phenomena associated with nausea, bilious or acrid vomiting, and bilious purging, accompanied by twisting or griping pains in the abdomen. The bile is very acrid and causes smarting when voided. Various nervous phenomena as headache, irritability of temper, depression of spirits, and general malaise are common symptoms. The urine is generally high coloured and full of lithates; occasionally there is palpitation of the heart and irregular pulse.

Defective biliary secretion.—The secretion of bile is diminished by low diet, free exercise, and purgation. The uses of bile in promoting the assimilation of fat, in increasing the peristaltic action of the bowels, and as an antiseptic are well known. When there is protracted deficiency of bile, dyspeptic symptoms, as a coated tongue, foul breath, bitter or unpleasant taste in the mouth, loss of appetite, and flatulent distension of the stomach are ordinarily present. The bowels are irregular, but generally costive; the stools are pale or white and are very offensive. The face is sallow or of a leaden hue. The patient looks emaciated and complains of loss of flesh. The pulse is often irregular and slow, and various nervous phenomena are present, such as more or less weakness, great drowsiness and depression of spirits. The urine is scanty, very dark coloured, often turbid and full of [illegible].

Treatment.—Medicines which promote the expulsion of bile, the secretion of bile are mercury, taraxacum, podophyllin, euonymin, iridin, hydrochlorate of ammonia, [illegible] &c. Mercury and its preparations are highly useful in sluggish conditions. In excessive secretion of bile a single dose of calomel at night and [illegible] by a black draught the next morning, produces speedy relief. The same good results are seen in cases of lithæmia. Small doses of calomel, combined with colocynth or rhubarb, give relief in ordinary cases. Where calomel does not produce the desired effect it should not be continued, as under its prolonged use the general nutrition and digestion are apt to suffer. Other purgatives may be substituted. Among these podophyllin holds a very prominent place. It should be given in quarter- to half-grain doses, with extract of henbane or cannabis indica to prevent griping. A good formula is as follows:—Podophyllin, gr. j; essence of ginger, ʒj; rectified spirit, ℥j. A teaspoonful in water at bedtime every night, or every second, third, or fourth night, as required. Some give rhubarb, aloes, or colocynth with podophyllin, to expedite its action. In a few cases podophyllin does not act, and in some cases it produces violent griping and straining and irritation of the intestines.

When the patient is gouty or suffering from lithic acid diathesis taraxacum is very useful, both as an alterative and as a laxative. It should always be given with some alkali. Nitromuriatic acid is another remedy. It does most good in oxaluria with torpid liver. Various mineral waters which contain sulphate of magnesia, as the Pullna, Friedrichshall, and Hunyadi are efficient substitutes for ordinary medicinal aperients. The Carlsbad waters owe their action to the presence of sulphate of soda which they contain. The association of carbonate of soda with the sulphate gives the water an antacid property, and causes it also to act as a diuretic. Other means to be adopted are regularity of diet, bodily exercise, such as walking or riding, fresh air, and freedom from harassing care and anxiety.

The action of the skin should be promoted by baths and adequate clothing. The diet should be nutritious, but not rich nor stimulating. Starchy and saccharine food should be avoided and the nitrogenous preferred. Light wines may be allowed, but the use of spirits should be interdicted.

JAUNDICE.

Jaundice, otherwise known as icterus or morbus regius, is a symptom of many hepatic affections. The word icterus literally means a yellow bird. It implies yellow discolouration of the tissues of the body, and chiefly of the skin and conjunctivæ; the secretions also become discoloured, owing to the impregnation of the blood with bile pigment, to the deposition of bile in various tissues, and to the separation of its colouring matter by various emunctories.

Causes.—Jaundice arises in one of two ways:

1. Cases of obstructive jaundice are those in which bile is mechanically prevented from flowing into the duodenum owing to some impediment. The bile therefore is retained in the biliary passages and absorbed into the blood.

2. Cases of jaundice where the bile is not prevented from flowing into the duodenum, but is not formed in normal quality and quantity. Such cases are more common than those of the former kind.

During health the bile is propelled onwards in the bile ducts by pressure from behind. During inspiration the diaphragm presses on the liver, and the bile, so long as there is no mechanical obstacle in the ducts, is pushed onwards and passes into the duodenum. In the biliary passages a large portion of bile is taken up by the lymphatics and veins, and consequently reabsorbed into the blood; the remainder passes onwards into the bowels, and a portion is discharged with the fæces. The quantity of bile secreted in twenty-four hours is about forty ounces, but it varies with the quantity and quality of the food, with the activity of respiration, and other conditions. The fæces contain a portion of bile acids and bile pigment. The bile acids are altered in their passage through the bowels. The bile pigment is in very small quantities, and some portion of it goes to form urinary pigment. Much of the bile pigment secreted by the liver is not discharged with the fæces, for under cholagogues, as calomel or taraxacum, the bile pigment discharged by the bowels is greatly increased without any corresponding increase of the secretion of bile by the liver. A large portion of the bile which is not discharged from the bowel is again absorbed by the biliary passages, and also by the mucous membrane of the bowel. Here the bile is filtered through these membranes, and thus enters the blood. Thus a kind of osmotic circulation takes place between the bile and the blood. Much of the bile is transformed into effete products, which are eliminated by the lungs and kidneys. It also assists in the assimilation of nutritive materials from the food, and thus serves in the repair of the tissues. Under normal conditions the whole of the bile that is absorbed undergoes metamorphosis, and thus no trace of bile acids or bile pigment is discovered in the urine or blood, and there is no jaundice. In certain morbid conditions the absorbed bile does not undergo the necessary changes, and it therefore circulates in the blood, and its effects are manifested in the tissues and skin, and jaundice results without any obstruction in the biliary passages. Experiments made by injecting bile acids into the blood have proved that these acids have the power of dissolving the red corpuscles of the blood, and also of converting the colouring matter into that of the bile. Further experiments have shown that jaundice can be produced by injecting other substances into the blood which dissolve the blood-corpuscles.

In cases of jaundice from obstruction there is impediment to the flow of bile through the hepatic or common ducts. The bile ducts and the gall-bladder thus become distended with bile, which is absorbed by the lymphatics and the veins. In obstruction of the bile duct the lymphatics of the liver are found to contain bile.

Many different opinions are held as to the cause of jaundice in those cases in which there is no impediment to the flow of bile from the liver into the bowel. The most probable explanation is, that the bile, which is absorbed by the bile passages and the bowel, is not transformed in a normal manner. Some suppose that the jaundice is a result of suspended secretion. They maintain that the function of the liver is selective, *i.e.* that this organ merely separates from the blood those materials which go to form bile, and which already exist in that fluid. If the proper function of the liver be interfered with, the elements of the bile accumulate in the blood and jaundice results. Others again assert that the liver forms bile acids, while bile pigment is derived from the colouring matter of the blood, and is only excreted by the liver. Those who are opposed to this view assert that, although the bile pigment is derived from the colouring matter of the blood, it does not exist ready-formed, and that bile pigment is not found in the portal blood. Hence it may be inferred that both the bile acids and bile pigments are formed in the liver itself. Those who have discovered bile pigment in the blood have probably investigated cases in which the bile had become absorbed. If the theory that the liver only separates the elements of bile from the blood be true, in cases where the hepatic tissue is considerably degenerated and destroyed, jaundice should be a marked symptom. After extirpation of the kidneys, urea is found accumulated in the blood; but after the liver has been removed, the elements of bile are not similarly discoverable. Another and more plausible explanation about jaundice, in cases not due to mechanical impediment, is, that the liver forms bile acids which, during health, are partly absorbed by the bowel and partly taken up by the hepatic vein into the blood. Under ordinary circumstances they become oxidised, and assist in forming taurin, which is taken up by the lungs, and the pigments which are voided in the urine. Where these changes are interfered with, as happens in cases of poisons in the blood and from other causes, the bile acids, not being sufficiently oxidised, are converted into bile pigments and lead to jaundice. That the bile acids can readily be converted into bile pigments has been shown by adding concentrated sulphuric acid; and when bile acids are injected into the veins of dogs they are converted into bile pigment.

Causes of obstructive jaundice.—Obstruction in the hepatic or the common bile duct may be due to:—1. Inflammation of Glisson's capsule, leading to thickening and subsequent compression of the duct; impaction of foreign bodies in the duct, as gall-stones, inspissated bile, hydatids, and fluke-worms; or foreign bodies from the intestines. 2. Organic and inflammatory changes in the walls of the duct, as tumefaction or exudation into its interior. 3. Tumefaction of the duodenum. 4. Organic stricture or obliteration of the ducts, as by perihepatitis. 5. Ulcers in the duodenum. 6. Ulcers in the bile ducts. 7. Obstruction by spasmodic stricture. 8. Pressure of tumours, closing the orifice of the duct, either from without or growing in its interior. 9. The pressure on the duct by tumours from the liver itself, by enlarged glands in the hepatic fissure; by tumours of the stomach, duodenum, pancreas, kidneys, or omentum; by abdominal aneurysm, pregnant uterus, ovarian and uterine tumours and fæcal accumulation in the bowels. Catarrh is the most common cause of jaundice due to mechanical obstruction.

The other main class of jaundice is independent of mechanical obstruction. It is due to causes which interfere with the normal changes of bile. These causes are: Poisons in the blood, as in various specific fevers. Jaundice of this kind is seen in yellow fever, relapsing fever, typhoid and typhus fevers, scarlatina, and malarial fevers; epidemic jaundice and in acute yellow atrophy of the liver. Jaundice also sometimes occurs in pyæmia and as a result of snake bites. A similar variety of icterus is occasionally seen in cases of mineral poisoning, as by arsenic, phosphorus, antimony, mercury, and copper. Inhalation of chloroform and ether may lead to jaundice. Jaundice occasionally occurs in delirium tremens, and in those addicted to the use of strong drinks. It has been sometimes noticed as a result of faulty or deranged innervation, as in severe mental emotions, fright, or anxiety. It is also common in cases where the oxygenation of blood is interfered with as in lung-diseases. Excessive secretion of bile is another cause of jaundice. This is common in cases where more bile is secreted than can undergo normal metamorphosis. Jaundice is also an occasional result of disintegration of blood-corpuscles. This is sometimes seen in cases of [illegible] (hydræmia) where, owing to a large amount of water in the blood, the blood-corpuscles are dissolved.

Symptoms.—Jaundice is a symptom of many diseases and very often an appearance like jaundice is due to causes unconnected with the secretion of bile. Thus in chlorosis the surface has a greenish-yellow colour. A similar yellowish condition of the skin is also noticed in cases of cancer in which the liver is not attacked. Newborn children sometimes have a yellow hue of skin a few days after birth. In Addison's disease a similar colour exists. Exposure to malaria, lead-poisoning, and anæmia due to chronic structural diseases of any organ sometimes produce a yellowish hue of the surface. All these spurious discolourations can be readily diagnosed from true jaundice.

As a symptom jaundice presents many clinical phenomena. As already remarked there is discolouration of the tissues of the body, the skin and conjunctivæ in particular. There is also discolouration of the secretions as the saliva, urine, and sweat. The fluid of blisters is often found of a yellow colour.

Discolouration of the skin.—In obstruction to the passage of bile through the common duct, discolouration of the conjunctivæ first appears within twenty-four hours. The skin is next affected; a certain concentration of the bile pigment is necessary for the discolouration to be manifested on the skin. The amount of discolouration varies with the cause, and the course the disease may take. It may be pale sulphur, or deep yellow; sometimes, as in black jaundice, it is deep olive or bronze colour. In cases of obstruction it is light at first and gradually becomes deeper if the obstruction increases, and lighter if it becomes less. In advanced cases the colour may become paler owing to the destruction of the liver tissue and to the small quantity of bile which is secreted. In obstructive jaundice the discolouration also varies with the quantity of bile secreted and the quantity of urine passed. The deep olive hue of the skin as a result of obstructive jaundice may be seen in cancer or gall-stones. In black jaundice the blood is highly deteriorated, and the discolouration is owing to the bile pigment being vitiated and dark, and also to the imperfect arterialization of the blood causing lividity of the surface of the body. Where jaundice is due to causes other than impediments to the flow of bile, the discolouration is slight, but the symptom is always of a serious import. The colour of the skin also varies with the age, with the amount of subcutaneous fat, and the complexion. It also varies from day to day with the activity of the skin and kidneys.

The secretions.—Besides the secretions from the skin and kidneys, others, as the saliva and tears, are sometimes tinged with bile. The secretions from the mucous surfaces, of the respiratory passages, nd of the alimentary canal are generally unstained. The sweat lands sometimes secrete perspiration of a yellow colour, so as to ain the bedclothes.

The state of the urine is characteristic. In jaundice its colour varies from a light saffron to that of porter, dependent upon the amount of bile pigment which it contains. The discolouration in the urine is generally noticed, even before the skin or the conjunctivæ are affected. In slight cases the discolouration of the urine is the only noticeable symptom of jaundice. In cases where the skin has been discoloured the urine is the first to clear up, and the skin remains yellow for some time longer. In cases of pneumonia associated with jaundice the expectoration often contains bile pigment.

Derangement of the digestive system.—*Bitter taste.*—The retention of bile acids in the blood causes a bitter taste to be experienced, which is not the case if bile pigments are alone present in the blood. It is a common symptom in biliary derangements, even without jaundice. The absence of bile from the evacuations causes the motions to be of a drab colour. Bile is an antiseptic, and when absent from the stools the motions are highly fœtid, and there is accumulation of gases. Moreover, the action of bile being to stimulate the peristaltic movements of the bowels, there is constipation when this secretion is absent. In those cases of jaundice where diarrhœa supervenes it is due to the irritant action of the putrid fæces. The stools are not much altered if jaundice be due to causes which lead to no impediment in the common bile duct. The assimilation of fat is very faulty in cases due to absence of bile in the passages. Such patients have an aversion for fat, and they generally lose flesh and strength.

Morbid sensations.—The retention of bile acids in the blood often leads to itching of the skin, which is chiefly noticed in cases of jaundice due to obstruction of the bile duct. Itching is a most distressing symptom, and often prevents sleep. It is absent in many cases of jaundice, and sometimes present in biliary derangements without jaundice.

Skin eruptions.—Urticaria, lichen, carbuncles, and xanthelasma are often associated with jaundice.

Temperature and circulation.—Jaundice sometimes suddenly appears in patients suffering from fits of shivering and fever of a malarious origin. The temperature is often as high as 104° or 105° in such patients. This is also the case where jaundice follows hepatitis. In ordinary cases the temperature is normal. The action of the heart is feeble, and the pulse is slower than natural in jaundice. This is due to the retardation of the heart's action and diminution of arterial tension, owing to the presence of the bile acids in the blood. In some cases the pulse falls as low as 40 or 50 in a minute. This symptom is of most common occurrence in jaundice due to obstruction of the bile duct. Hæmorrhages from various mucous surfaces, and also under the skin, are common. These are due to a poor state of the blood and to a diminution of fibrine and red corpuscles. In long-continued cases of obstruction the liver tissue becomes disintegrated, and hæmorrhages are especially common.

Nervous phenomena.—Yellow vision.—In persons who are jaundiced sometimes all objects appear of a yellow colour. This condition is known as xanthopsy. Similar yellow vision is common in cases where santonine is taken, and it also sometimes occurs in the subjects of night-blindness and in typhus. In these cases there is no jaundice. The symptom may be absent even when jaundice is very severe.

Irritability of temper is very common in jaundice. The spirits are dull and low; sometimes drowsiness and delirium occur. In long-standing cases of obstructive jaundice, where the liver tissue is considerably destroyed, a typhoid state ultimately sets in. This state is also found in jaundice due to suppression. In either case the result is due to an altered state of the blood. Some are of opinion that the cerebral symptoms are due to the cholesterine which is retained. They assert that cholesterine is an excrementitious product of the nervous tissue, which is eliminated from the body by the liver. When this is retained it acts as a poison in the blood, the same way as urea does. This theory is, however, untenable, inasmuch as where no bile passes into the bowel cerebral symptoms rarely occur. It has also been clinically established that cerebral symptoms are often found in slight cases of jaundice, and may exist in diseases of the liver without any trace of jaundice. The best explanation of this phenomenon is found in the fact that in cases where the function of the liver is arrested the metabolic processes in the albuminoid matters by which they are changed into less complex substances, as urea and uric acid, do not take place. Lithic acid and other less oxidised deleterious products, as leucin and tyrosin, are formed. These accumulate in the blood and tissues, and give rise to symptoms of blood-poisoning, analogous to those which occur in cases in which urea is retained. In malignant jaundice, where the liver structure is altogether destroyed, leucin and tyrosin take the place of urea in the urine, and they may also be found in the spleen, kidneys, and liver.

Chemical tests of urine containing bile.—1. Bile pigment is readily soluble in chloroform and alkaline fluids, slightly soluble in alcohol and ether, and insoluble in water. Nitric acid test (Gmelin's test): When a drop of the urine and a drop of nitric acid are brought into contact, changes of colour are observed, namely, violet, green, blue, and red. A more delicate test is with tincture of iodine, which gives a green colour with bile pigment. 2. Bile acids. To the urine in a test glass add a piece of sugar, and then pour into it slowly about one-fourth of its bulk of strong sulphuric acid. A deep purple colour will appear where the acid and urine meet (Pettenkofer's test). Besides acids and pigments, the urine also contains leucin and tyrosin, which are detected by the microscope. 3. Leucin. As obtained in an impure form, it crystallizes in greenish-yellow globular masses, which are often collected together and exhibit a radiated structure. 4. Test for tyrosin. Tyrosin crystallizes in exceedingly fine needles which are usually collected into feathery masses.

Diagnosis.—Besides the yellowish hue the high-coloured urine is characteristic. A similar change in this fluid may, however, be due to the dark colour of the ordinary pigment, or the urine may contain abnormal pigments from the administration of santonine, rhubarb, turmeric, &c. The chemical tests are the only guide. There are various characters by which the various forms of jaundice can be distinguished. In obstructive jaundice the biliary acids are found in the urine, but no effete products as leucin and tyrosin. In jaundice from suppression, the liver does not secrete bile and there are no bile acids in the urine. This distinction does not hold good in every case. Often in malignant jaundice bile acids are found in the urine, and they are absent in many cases of obstruction. Jaundice due to obstruction of the common bile duct causes definite changes in the appearance of the stools. The motions contain bile where there is no obstruction, and when the ducts are obstructed the motions are clay-coloured. Bilious motions may exist with jaundice from obstruction after the latter has been removed, while the jaundice still remains. Jaundice from obstruction is generally intense; that due to suppression is slight. The presence of a distended gall-bladder with jaundice points to its being due to obstruction of the duct. The onset of jaundice is sudden in nervous cases, and in cases of obstruction of the duct by a foreign body. In the latter there is biliary colic, vomiting, and clay-coloured stools. Jaundice is slow when due to pressure of a growth from without or within the duct. In such cases jaundice is ultimately intense and the stools are clay-coloured. Repeated attacks of jaundice point to its origin in catarrh or gall-stones. Pain in jaundice occurring in paroxysms points to gall-stones, cancer, hydatids, or to aneurysm of the hepatic artery. Jaundice with enlarged liver is found in cancer and cirrhosis of the liver; more rarely in pyæmic abscesses: in waxy liver and in enlarged glands in the portal fissure. Where jaundice exists with ascites it points to cancer or cirrhosis. Jaundice with increased temperature is secondary to acute febrile diseases or may be due to suppurating hydatids opening into the duct, to inflammation of the bile ducts, or to passage of a gall-stone. Cerebral symptoms suggest yellow atrophy, poisoning by phosphorus, specific fevers, pneumonia, or shock.

Treatment.—Jaundice due to suppression is more dangerous than that due to obstruction. In the former, typhoid and other low nervous symptoms and gastric and intestinal hæmorrhages are apt to arise. In ordinary cases of jaundice large doses of ipecacuanha are recommended. They should be given with the usual precautions in order to avoid vomiting. It is extremely desirable to promote the secretion of the liver and to relieve the portal congestion. If the temperature is high cold-sheet packing may be used, and the headache may be relieved by constant application of ice to the head. The pain and tenderness in the abdomen may be soothed by turpentine fomentations, or by a large linseed poultice. Purgatives are generally useful, and after the free evacuation of the bowels the jaundice is usually lessened. In all cases the cause must be sought for and removed as far as possible. The diet must be attended to. Fats, oil, sugar, and alcoholic spirits must be avoided. The urinary and cutaneous secretions should be promoted by means of diuretics and diaphoretics and warm baths. Where jaundice is due to obstruction the source must be ascertained and, if practicable, removed by purgatives. The bowels may be freely relieved by calomel and jalap, or by salines. When obstruction occurs from biliary calculi hot poultices must be applied to the hypochondrium, and the pain relieved by hypodermic injections of morphia. Chloroform inhalations may also be tried. Complications, as gastric catarrh, diarrhœa, or head symptoms must be combated, and each will need appropriate treatment. Euonymin and iridin are hepatic stimulants and are often useful in jaundice. Nitro-muriatic acid has also the same effect. Diarrhœa due to putrefying fæces may be relieved by creasote. In many cases where the obstruction is of long standing the gall-bladder becomes excessively distended, but any attempt at surgical interference should be avoided.

HYPERÆMIA OR CONGESTION OF THE LIVER.

In this condition there is uniform enlargement of the liver, but the organ preserves its normal shape. The amount of blood is increased either by greater afflux (direct) through the portal vessels or by impeded efflux, the result of obstruction or impediment to the return of blood to the heart. The first cause produces active

Death may be due to (1) impairment of nutrition and extreme debility; (2) persistent high temperature; (3) retention of pus, leading to pyæmia; (4) typhoid conditions and nervous symptoms superadded. In fatal cases the quantity of urine gradually becomes less. In favorable cases the abscess may undergo a complete cure, and the liquor puris becomes absorbed. In such cases the secretion of urine increases. In fatal cases the pus-corpuscles become further degenerated, and the abscess may burst into the peritoneum, giving rise to fatal peritonitis. Where the abscess opens into the lungs recovery commonly occurs. The chocolate-coloured sputa indicate that a large abscess has discharged itself through the lungs. Where the abscess finds an opening for itself without any interference the result is generally more favorable than when the abscess is opened artificially. In these latter cases the discharge usually lasts for a very long time, and the patient often sinks from exhaustion.

Diagnosis.—It is extremely difficult to diagnose a case of hepatic abscess in the early stage, and the difficulty is sometimes great even in advanced cases. The most noticeable or characteristic signs have reference to (1) the general aspect of the patient, (2) the enlargement of the liver, and in advanced cases (3) to a feeling of fluctuation. After the abscess has burst the diagnosis as to the seat of opening may often be made out with some amount of certainty. In the case of the lungs the sputa are characteristic. In the case of the pleura or the peritoneum there is sudden collapse. If the abscess open into the bowels there will be no marked symptoms, but the patient begins to improve. Hepatic abscess may be mistaken for cancer, but in the latter there are nodular protuberances and cancerous cachexia.

Pyæmic hepatic abscess.—In connection with pyæmia we sometimes find abscesses in the liver. They are of inconsiderable size and full of greenish purulent fluid. In this affection at first the liver-cells become swollen from imbibition of an albuminous substance, then follows disintegration of cells and of the parenchyma, finally cavities filled with disintegrated tissue elements are formed. On examining the liver the surface is less nodular than in cancer. As a rule there is no feeling of fluctuation. The symptoms are pain and tenderness, increased on deep inspiration. Jaundice is present in about 80 per cent. of cases. Ascites, enlargement of superficial veins, and œdema of the limbs are rare. The spleen is generally enlarged. In unfavorable cases pyrexia is more or less marked at different times, and alternates with rigors and profuse sweats. There are sudden variations of temperature. The patient gradually loses flesh and strength, diarrhœa sets in, the tongue spotted, and blood flows freely. The congestion may be general, or limited to certain regions with intervening lighter spaces. At first the congestion is uniform, but if continued for some time other changes manifest themselves, and the liver becomes of the well-known nutmeg character. In active congestion the portal vessels at the periphery of the lobules, and in the passive form the central vessels or the hepatic veins are distended and overloaded with blood. In the latter form the circumference of the lobules corresponding to the portal veins becomes anæmic and undergoes degenerative changes. Where the passive congestion has lasted for some time, as in mitral disease, the liver is enlarged, granular, and indurated, and the capsule is thick. On section the liver presents an appearance closely resembling a cut nutmeg. The nutmeg appearance is owing to the circumference being more or less pale and loaded with fat, while the central portion or the radicles of the hepatic vein are filled with blood, and the neighbouring hepatic cells are loaded with bile pigment. There is also dilatation of small branches of the hepatic veins within the lobules, and as a result of pressure atrophy of the hepatic cells. A further change is hypertrophy of the interlobular tissue and development of lymphoid bodies. In advanced cases the morbid changes are the same as in cirrhosis. There is at first hypertrophy followed by atrophy. Such a condition of liver is known as "atrophic nutmeg" liver, while that which is due to the distended state of the vessels in the centre is called "varicose atrophy."

Symptoms.—In slight cases there are no particular symptoms. The liver may be normal or slightly enlarged, and may then be felt below the right cartilages and in the epigastrium. In passive hyperæmia, due to obstructed circulation, the liver is much enlarged, and the edge can be clearly made out. There is greater resistance than natural. Percussion shows an increase in the extent of hepatic dulness, extending upwards into the mammary region, downwards to the umbilicus, and across to the left hypochondrium. In old-standing cases, in those due to long exposure to malaria or tropical heat, the amount of resistance is considerable, and may indicate albuminoid degeneration. In acute cases there is a sense of fulness and oppression and uneasiness from pressure of bedclothes, and also on lying on the left side. The suffering due to the previous heart or lung diseases is increased. The feeling of discomfort in the hepatic region is increased by movement, pressure, and respiration. The complexion is sallow. There is little or no jaundice, the spleen is enlarged, and occasionally there is slight dropsy. The patient complains of fulness and discomfort after food, disinclination to work, and headache. There is occa-

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Hepatic congestion is very often due to malaria. In these cases a purgative dose of calomel with rhubarb or of podophyllin is of great benefit. These may be combined with cannabis or hyoscyamus. Quinine should afterwards be given, and the patient must leave the malarious locality. In active congestion, due to errors in diet, high living, or to excessive heat, the best line of treatment is to forbid irritating articles of diet, and to give refrigerants or cooling drinks. In these cases mild mercurial aperients or saline purgatives act favorably by unloading the portal system. If the patient is weak and the bowels constipated an enema of castor-oil with turpentine and assafœtida will relieve the symptoms. In all cases stimulants should be avoided. In advanced cases after the acute stage taraxacum is very serviceable; it acts both as a purgative and as an alterative, and may be combined with nitro-muriatic acid. In persons of gouty habit bicarbonate of potash should be given instead of the acid. The acid acts by promoting and altering the secretion of bile, and it also assists digestion. If the urine be scanty copaiba or benzoate of ammonia gives relief. When, as in advanced cases, the tongue is dry and raw looking, stimulants may be given from time to time. Locally, should there be much tenderness on pressure over the region of the liver, the application of mustard plasters or of turpentine stupes, followed by hot poultices, will afford much relief. In active congestion an emetic may be useful. To effect a diminution in the size of the organ hydrochlorate of ammonia and iodide of potassium are sometimes useful. Ipecacuanha, owing to its power of increasing the secretion of the liver and skin, is a valuable remedy, and is most efficacious in the hands of Indian practitioners. Mineral waters, as those of Carlsbad, Kissingen, and Marienbad, are beneficial. During convalescence good diet, mineral acids, and taraxacum with nux vomica are indicated. In chronic cases nitro-muriatic acid given internally, and the lotion of it used as a compress to the hepatic region, is very beneficial. The acid is often used locally in the form of a footbath or for sponging the body, the proportion being one part of the dilute acid to twenty parts of lukewarm water. The compress is formed of a broad piece of flannel, which is soaked in the solution and put over the abdomen and covered with oiled silk. It should be changed two or three times a day.

HEPATITIS—INFLAMMATION OF THE LIVER.

The inflammation may be either acute or chronic. The chronic form is often described as cirrhosis of the liver.

Acute hepatitis is an inflammation involving the parenchyma of

Cirrhosis literally means reddish yellow, or tawny. The condition is characterised by a slow destruction of the hepatic cells and an increase of the connective fibrous tissue. The disease is generally chronic, beginning insidiously and extending over several years. In it the liver is probably increased in size at first, but afterwards becomes much diminished in bulk.

Cirrhosis is a chronic interstitial inflammation or hypertrophy of the fibrous covering of the liver and of the connective tissue (Glisson's capsule) which surrounds the vessels within the organ. The inflammation extends into the minutest portal canals, leads to proliferation of cells between the lobules, and to the exudation of lymph, which readily organises and causes pressure upon and obliteration of the vessels, thus diminishing the nutrition of the secreting cells and causing their atrophy.

Causes.—The disease occurs in persons between thirty-five and sixty, and is more common in males than in females, and in persons who are in the habit of drinking undiluted spirits. Hence it is called *gin-drinker's* liver. A hot climate, abuse of hot spices, and syphilis also give rise to it. In some cases there is a history of dysentery leading to an embolus in one of the branches of the portal vein.

Morbid appearances.—In the *first stage* the liver is enlarged, increased in thickness, and its peritoneal covering clouded. Externally some slight elevations are noticed. The surface is smooth and abnormally firm and dense. On section the parenchyma is seen to be traversed by vascular greyish-red bands which give the organ a fleshy look, and consist of connective-tissue striæ with spindle-shaped cells. In the *second stage* the liver is extremely small and pale, and the surface presents numerous granular projections. The liver may be one-half or one-third of its natural size. The contraction is greatest in the left lobe, which is often reduced to a mere membranous appendage. The edges are thin and contain only transparent tissue, but none of the liver elements. The capsule is thick and inseparable, and false membranes often join the surface of the liver with the diaphragm and other neighbouring parts. When the capsule is torn off the surface of the liver appears covered with small elevations, and the organ is hard and tough. The granules appear as yellow bodies surrounded by white connective tissue, and are the remains of the healthy liver tissue. In some cases all the lobules are more or less involved in the change, and they are often lost in the growth. The cells of the liver are flattened, atrophied, and degenerated, and are yellowish from the accumulation of bile pigments, and resemble bees-wax. In one portion of the liver the development of the connective pain in the right shoulder, and a short, dry cough. The pain in the liver varies. Where the convex surface is involved the pain is sharp and lancinating; in other cases it is dull and heavy. It increases when the patient changes his position or tries to lie on the left side; also with deep inspiration, coughing, sneezing, &c. The liver is often tender and enlarged, and there is increased hepatic dulness. The enlargement may be in any direction upwards and backwards, or downwards and towards the epigastrium. In acute cases, where the under surface of the diaphragm is inflamed, there is great dyspnœa.

Terminations.—If the capsule alone is inflamed the symptoms will subside in three or four days; but where the inflammation is deep seated the duration is longer. It may end in resolution about the middle of the second week, or may become chronic, ending after a few weeks in enlargement or chronic induration. It may also end in suppuration, especially in residents within the tropics.

Diagnosis.—In hepatitis the patient generally lies on the affected side, and there is great irritability of the stomach. In perihepatitis the pain is very acute but less persistent; in hepatitis the pain is of a dull character, but is more persistent. When the pain is lancinating and the patient is short of breath, the case may be mistaken for pneumonia of the right lung or for pleurisy. The auscultatory signs will determine the diagnosis. In hepatalgia and in hepatic colic the patient does not lie on the affected side as in hepatitis. The pain of gall-stones comes on suddenly, is more acute, and disappears rapidly.

Prognosis.—This is favorable in hepatitis occurring in persons of temperate habits and residing in a cool climate. Where the case is one of perihepatitis the prognosis is generally more favorable than in one of parenchymatous inflammation. The prognosis is unfavorable in persons of intemperate habits and within the tropics, as the inflammation often runs on to hepatic abscess. As there is a tendency to relapse the prognosis must also be a guarded one, inasmuch as a state of chronic induration or hyperæmia of the organ with enlargement is apt to occur. Where hepatitis is associated or complicated with dysentery or chronic diarrhœa the prognosis is very unfavorable. In India and other hot countries the disease is most rife and serious.

Treatment.—In acute cases the inflammation should be relieved by leeches applied over the liver. In cases in which the pain is dull linseed-meal poultices should be constantly applied to the affected side. The fever may be combated by diaphoretics and salines, and the bowels should be acted upon by neutral salts. Where hepatitis is complicated with dysentery ipecacuanha in

There is also œdema of the legs, thighs, and scrotum, and of the abdominal walls. There is rarely much biliary obstruction, hence the patients have a dirty yellow, but not intensely jaundiced look. The urine is scanty, acid, and dark coloured, and contains bile and other colouring matter, and sometimes albumen. Sometimes coma, drowsiness, delirium, and even convulsions occur. In later stages, as the effused growth greatly obstructs the flow of blood through the portal vessels, *hobnailed* liver may be felt externally, and the dropsical effusions gradually increase. In this stage there is diminution of the area of the hepatic dulness. The liver gradually becomes smaller. It is difficult to determine its size in cases of ascites, but by laying the patient on the left side the hard edge of the liver can sometimes be felt by depressing the walls of the abdomen with the fingers. Percussion reveals diminution in the hepatic dulness to perhaps an inch or two in the nipple line.

The ascites is due to obstruction in the portal circulation. In the connective-tissue growth new vessels form and replace to some extent the obliterated hepatic vessels, but they are insufficient for the hepatic circulation, and portal obstruction is the result. This is relieved by the ascites, by diarrhœa, and by hæmorrhoidal discharges. Another source of relief is the development of varicose communications between the radicles of the portal system and the general veins.

As a rule the spleen is enlarged to double or treble its size, and is soft and pulpy. These changes are supposed to be due to portal obstruction acting on the splenic vein. In nutmeg liver, however, the spleen does not always swell.

Diagnosis.—There is a history of hard drinking and the physical signs of small contracted liver, enlarged spleen, ascites, and dropsy of the legs, thighs, and scrotum, a leaden hue of the face, slight jaundice, hæmorrhages from the stomach and bowels, and severe dyspeptic symptoms are characteristic of cirrhosis. The liver is large at first; as the case progresses it contracts. It is also irregular in shape and covered with small elevations on the surface. Cirrhosis may be confounded with nutmeg liver, syphilitic hepatitis and perihepatitis, waxy and fatty liver, cancer, hydatids, thrombosis of the portal vein, obliteration of the hepatic duct, and chronic peritonitis.

Hypertrophous cirrhosis is characterised clinically by enlargement of the liver, marked jaundice, and sometimes by the absence of ascites. The enlargement is uniform, the liver is smooth, dense, yellowish in colour, and has a sharp, well-defined anterior border. On section it is found to be infiltrated with greyish dense connection sometimes becomes so affected that even after the lapse of several years the system is predisposed to hepatic abscess. Such cases are often met with among Europeans in their own land even some years after their return from India.

Various other causes conduce towards the development of hepatic abscess. Thus, injury or blows, or any other direct violence, as impaction of gall-stones, especially when they are rough and pointed, are sometimes followed by suppuration.

Morbid appearances.—The course and formation of an hepatic abscess is as follows :—At first there is hyperæmia, followed by inflammatory exudation. The exudation products may be deposited in different parts of the liver at the same time, or may occupy only one spot. In character the deposit consists of lymph and pus. Two or three deposits often coalesce, and the liver substance thus breaks down. It is in this way that the abscess generally extends. Where the formation of an hepatic abscess is rapid the membrane lining the cavity is a kind of cyst with thin walls, but in slow-growing abscesses the walls are thick. Where the abscesses are numerous and the enlargement of the liver not very great they are generally of pyæmic origin. Idiopathic abscesses are generally large and unilocular, and either single or in small numbers. Such abscesses are known as tropical hepatic abscesses. In size they vary from that of an orange to that of a large cocoa-nut, and the larger ones may contain several pints of pus. The pus is generally quite laudable so long as the abscess is excluded from the air. In some cases the pus is of a dark brown colour ; in others streaks of bile are mixed with it. Abscesses are most common in the right lobe. They may be found on the surface and may have burst, or they may be deep-seated. The abscesses may open into various channels. The contents may be conveyed into the portal vessels and an embolus may be lodged in some distant part. When conveyed along the hepatic duct the contents are discharged into the bowels, and this is the most favorable course. Sometimes the abscess finds its way to the surface, and opens externally. This happens when the abscess is seated on the portion of the liver which has extended below the ribs. The abscess may also open into the peritoneal cavity, the gall-bladder, the stomach, or inferior vena cava. If seated near the convex surface, the diaphragm and the liver sometimes become adherent, and the abscess opens through the diaphragm into the pleura or pericardium. In the latter case the result is always fatal. When the abscess opens into the lung the result is often favorable. After an abscess has burst it leaves a cicatrix or causes membranous formations or depressions on the surface of the liver. Such depressions, are, however, more often

ACUTE YELLOW ATROPHY OF THE LIVER—MALIGNANT JAUNDICE.

Yellow atrophy, also called hæmorrhagic or malignant jaundice, is a very rare affection, and results from a diffuse parenchymatous inflammation or degeneration of the liver. It is a general disease and is characterised by marked jaundice, coffee-ground vomit, low typhoid and cerebral symptoms, and by atrophy of the liver. The spleen is enlarged, and there is degeneration of the heart and the glandular organs. The secretion of bile is more or less completely suspended, and there is rapid and complete destruction of the hepatic cells, which are filled with albuminous granules. These are followed by oil-particles and oil-globules. In the muscular tissue the striæ are lost, their place being taken by granules. The liver is considerably diminished in size; it becomes soft, yellow, and pulpy, and there are no traces of lobules. The disease runs a very rapid course.

Causes.—Acute yellow atrophy is more common in women than in men, and in the former most frequently during pregnancy. Great anxiety, sudden alarm, fits of passion, syphilis, excesses of any kind, a poisoned state of the blood as due to malaria, typhus, or any other fever, and long-continued use of or poisoning by phosphorus, mercury, antimony, or arsenic, have all been cited as causes of this disease.

Pathology.—Yellow atrophy is a result of a peculiar form of hepatitis. It is probably a parenchymatous inflammation, in which there is little or no exudation. There is obstruction to the vessels at the periphery of the lobules, and the hepatic cells undergo molecular and fatty degeneration. Jaundice and the cerebral symptoms are secondary to the liver disorder. Some believe atrophy to be a consequence of the action of some poison in the blood, either the result of faulty digestion and assimilation, or an independent poison similar to that of pyæmia or syphilis. They further suppose that some of the grave symptoms belong to the primary disease, and that the disorder of the liver is a secondary one. They find nothing in the clinical history to indicate an inflammatory origin. Those who hold the opposite view regard the destruction of the hepatic cells with suppression of bile as enough to induce all the changes observed in this affection, without the existence of any blood-poison.

Morbid appearances.—In the early stage the changes in the liver are not characteristic. The organ may be of natural size, or even enlarged. Later on it is diminished to one-half or one-third of its bulk, and in extreme cases it weighs less than twenty ounces, the no pain. In such cases tenderness is not noticed. Though the pain is dull and heavy, and not of a throbbing character, it is increased on deep inspiration and coughing. In deep-seated abscesses, when they approach the surface, the fever and acute pain manifest themselves. There is often marked rigidity of the right rectus muscle, and a constant pain in the right shoulder. Throughout the whole course of suppuration such symptoms as ascites, enlargement of superficial veins, œdema of lower limbs, and enlargement of spleen are generally absent. Jaundice may be present, but is not persistent. The existence of hectic fever, rigors, night sweats, diminished amount of urea, and frequent pulse are characteristic of suppuration, but they are less marked in hepatic abscess due to hepatitis than in pyæmic abscesses.

In pyæmic abscesses the symptoms somewhat vary. The pyrexia is present at some period or other during the twenty-four hours. The patient suffers from looseness of bowels, the number of stools amounting in twenty-four hours from three to ten. The quantity of urine passed in twenty-four hours seldom exceeds forty ounces. It is of an acid reaction, and the specific gravity is high. There is great thirst and loss of appetite; sometimes vomiting is very obstinate. The tongue is coated or red. In sthenic cases the febrile disturbance is high, and the urine is very scanty. In asthenic cases the fever assumes a typhoid character. The respirations are hurried, about 30, shallow, and often intercostal, and there is more or less dyspnœa, short, dry cough, and hiccough. In hepatic abscess the pain is often characteristic. When sharp and lancinating it shows that there is implication of the serous covering, but when dull the parenchyma is only affected. When the abscess is confined to the convex or upper surface of the liver the chest symptoms, as cough, dyspnœa, and hiccough, will predominate. When it affects the lower surface the derangements of the stomach will be most marked. As the case progresses the patient becomes more and more emaciated, and prostration with diarrhœa or dysentery sets in.

The symptoms of hepatic abscess are very often vague and misleading, and not so marked as those above described. It sometimes happens that hepatic abscesses are not discovered until after death, there having been no symptoms of the disease during life. In many cases the abscess supervenes in the course of dysentery or pyæmia, and the symptoms of suppuration are masked by those of the precedent diseases. In some insidious forms the abscess may exist without any fever or shivering, the only sign being falling off of health.

Hepatic abscess is always dangerous, and often proves fatal.

Death may be due to (1) impairment of nutrition and extreme debility; (2) persistent high temperature; (3) retention of pus, leading to pyæmia; (4) typhoid conditions and nervous symptoms superadded. In fatal cases the quantity of urine gradually becomes less. In favorable cases the abscess may undergo a complete cure, and the liquor puris becomes absorbed. In such cases the secretion of urine increases. In fatal cases the pus-corpuscles become further degenerated, and the abscess may burst into the peritoneum, giving rise to fatal peritonitis. Where the abscess opens into the lungs recovery commonly occurs. The chocolate-coloured sputa indicate that a large abscess has discharged itself through the lungs. Where the abscess finds an opening for itself without any interference the result is generally more favorable than when the abscess is opened artificially. In these latter cases the discharge usually lasts for a very long time, and the patient often sinks from exhaustion.

Diagnosis.—It is extremely difficult to diagnose a case of hepatic abscess in the early stage, and the difficulty is sometimes great even in advanced cases. The most noticeable or characteristic signs have reference to (1) the general aspect of the patient, (2) the enlargement of the liver, and in advanced cases (3) to a feeling of fluctuation. After the abscess has burst the diagnosis as to the seat of opening may often be made out with some amount of certainty. In the case of the lungs the sputa are characteristic. In the case of the pleura or the peritoneum there is sudden collapse. If the abscess open into the bowels there will be no marked symptoms, but the patient begins to improve. Hepatic abscess may be mistaken for cancer, but in the latter there are nodular protuberances and cancerous cachexia.

Pyæmic hepatic abscess.—In connection with pyæmia we sometimes find abscesses in the liver. They are of inconsiderable size and full of greenish purulent fluid. In this affection at first the liver-cells become swollen from imbibition of an albuminous substance, then follows disintegration of cells and of the parenchyma, finally cavities filled with disintegrated tissue elements are formed. On examining the liver the surface is less nodular than in cancer. As a rule there is no feeling of fluctuation. The symptoms are pain and tenderness, increased on deep inspiration. Jaundice is present in about 80 per cent. of cases. Ascites, enlargement of superficial veins, and œdema of the limbs are rare. The spleen is generally enlarged. In unfavorable cases pyrexia is more or less marked at different times, and alternates with rigors and profuse sweats. There are sudden variations of temperature. The patient gradually loses flesh and strength, diarrhœa sets in, the tongue becomes brown and covered with sordes, and delirium closes the scene. Such cases, however, sometimes run a chronic course.

Prognosis.—It varies with the amount of urea excreted. Where the quantity is extremely small very little of the secreting structure of the liver remains, and a fatal termination may be expected. A rapidly decreasing amount of urea presages the near approach of death. In favorable cases the quantity of urine and urea increases. The weight of the patient is also a guide in this affection. There is in fatal cases a rapid fall of several pounds in four or five days. If the pus is discharged through the bowels or the lung there is some prospect of recovery. Very much depends upon the general condition of the patient and the previous history of the case.

Treatment.—The measures to be adopted for the treatment of acute hepatitis have been described in the preceding chapter. When abscess is suspected all depleting remedies must be discontinued, and the patient's strength should be supported by tonics and nutritious diet. Gentle aperients are advisable from time to time, but mercurials should be avoided. A course of nitro-muriatic acid is likely to be beneficial, and if febrile symptoms are present quinine is of course indicated. Counter-irritation is unadvisable, unless for the sake of relieving pain. The patient should be carefully watched and placed under the most favorable conditions. No active interference is advisable unless the abscess point externally. Even under these circumstances opinions differ as to the expediency of making an artificial opening; but in cases where fluctuation is quite evident, and where the pus is close to the surface, much relief may be afforded by opening the abscess. The operation should be performed by means of a trocar and cannula connected with an aspirator. The introduction of air should be avoided, and antiseptic precautions should be rigorously observed. It is best, when possible, to make the opening below the ribs. After the evacuation of the abscess the treatment suitable for chronic hepatitis should be persevered with, and all possible measures adopted to improve the general health. In cases where the discharge is fœtid, and adhesions have formed, some recommend a free incision and the injection into the cavity of an antiseptic lotion. It has also been suggested to insert a drainage-tube.

CIRRHOSIS OF THE LIVER.

It is otherwise known as granular liver, hobnailed liver, gin-drinker's liver, and interstitial hepatitis.

In this chronic inflammatory disease the liver is hard, usually more or less contracted, and has a hobnailed or granular appearance.

Diagnosis.—The liver is enlarged, but its shape is not altered. There is no pain and no other indication of malignant disease. The habits of the patient, and in other cases the coexistence of phthisis or other wasting diseases, will help to indicate the nature of the case.

Prognosis.—This is unfavorable in advanced cases and in those associated with phthisis.

Treatment.—The cause must be ascertained and dealt with as far as possible. When the disease is due to gluttonous habits the line of treatment is obvious. Alcohol should be interdicted, and a non-stimulating diet, with exercise and attention to the functions of the skin, should be enjoined. The use of certain alkaline purgative waters, as those of Carlsbad and Marienbad, is beneficial. In cases of fatty liver associated with phthisis little can be hoped for from treatment.

AMYLOID LIVER.—ALBUMINOID DISEASE OF THE LIVER.

This affection is characterised by considerable though painless enlargement of the liver. The enlargement is greater than in any disease except cancer, and the function of the liver is altogether abolished. The structure of the organ is infiltrated with a peculiar homogeneous substance, which has a close relation to certain cachexias and constitutional disorders, as syphilis, scrofula, rickets, chronic diseases of bones and joints, and chronic suppuration. The disease has been noticed as a complication of chronic dysentery, ague, and hereditary syphilis. It is generally associated with lardaceous degeneration in other parts. (See vol. i, p. 246, *et seq.*)

Morbid appearances.—In amyloid liver each lobule is divided into three zones; the deposit at first appears in the middle zone, midway between the centre and the periphery, where the hepatic artery is distributed. The change first affects the walls of the arteries, and then the hepatic cells. The new material then extends to the centre and also to the periphery of the lobules. The arteries become thick, and the cells enlarge and lose their normal structure. They are of irregular form, and their nuclei are considerably reduced in size. Under the microscope the new material has a transparent, lustrous, and swollen appearance. The affected lobule is pale, glistening, and quite homogeneous. The weight and size of the liver are greatly increased. It fills a large portion of the abdominal cavity. Its form is not altered; it is hard, resistant, and inelastic and the surface is smooth and glistening. It is called lardaceous, because it cuts like a piece of bacon. It is also called waxy, because of its consistence. When cut its surface is grey or tissue may be taking place, while in another the processes of contraction and atrophy may be far advanced. This is the most common form, but there are certain modifications. That known as *hypertrophous cirrhosis* is characterised by increase both in weight and size; the surface is smooth; the capsule thick, but leaving a smooth surface when removed. When cut into the liver is tough, and presents the same appearances as in ordinary cirrhosis just described. That known as *fatty cirrhosis* is a condition which resembles fatty liver, but in the former the organ is tough and the cut surface is indistinct, pale, and yellow. The external surface is smooth. In fatty liver the edge is everted, and on section acini are discoverable. Under the microscope the liver-cells are seen to have lost their polyhedral shape and to have become oblong, oval, or spindle-shaped. In some cases they are infiltrated with fat. Between them there is development of new connective tissue. The normal tissue of the liver is replaced by highly nucleated connective tissue. The nuclei, otherwise known as lymphatic corpuscles, vary in size and shape. They are probably nothing more than emigrated leucocytes, and are arranged in lines corresponding to the distribution of vessels carrying blood or bile. The connective tissue is highly fibrous, and sometimes granular.

Symptoms.—These are often very insidious, and may be classified as those which precede obstruction of the portal veins, and those which follow. For a long time there may be no manifest symptoms to attract attention. In the *first stage* in many cases there are indications of ill-health, with progressive loss of strength and emaciation, and there may be some evidence of contracted granular kidneys, such as scanty urine and slight dropsy of the abdomen. In some cases the habits of the patient with regard to alcohol may suggest cirrhosis. In a majority of cases in the early stage the symptoms are those of congestion of the liver, gastro-enteric catarrh, and slight fever. There is alcoholic dyspepsia, sickness, and retching in the morning, loathing for solid food and desire for stimulants, and one of the first symptoms is a dull pain or tenderness in the liver or in its neighbourhood. On examination the liver is found to be enlarged. In the *second stage* the symptoms depend almost entirely on obstruction of the portal circulation. The mechanical compression of the portal veins causes congestion of those organs which send their blood to the liver, and enlargement of the superficial abdominal veins. The compression of the hepatic ducts causes obstruction of bile and jaundice. There is chronic gastric catarrh, general cachectic appearance, and gastric or intestinal hæmorrhage; there may also be hæmorrhoids. The spleen is enlarged. The belly begins to swell, and ascites appears.

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Atrophic cirrhosis.—The prominent symptoms of this form are ascites and gastro-intestinal derangements, but hæmorrhages are absent. The dropsy is slight and it comes on very late in the disease. Jaundice is either slight or absent. The existence of bile in the blood leads to cerebral and other symptoms due to bile poison. There is no enlargement of the superficial abdominal veins, but the spleen is hypertrophied.

Prognosis.—This is always serious, as a fatal result is the almost certain issue. When the second stage has set in the progress of the disease cannot be arrested.

Treatment.—The most important indication is to alter the habits of the patient. Alcohol in every form should be forbidden, and an unstimulating diet strictly enjoined. The use of alkaline purgatives is generally beneficial. They may be combined with vegetable bitters. If there be suspicion of syphilis iodide of potassium is indicated. Exercise on foot or horseback should be enjoined, and all hygienic rules should be carefully attended to. Chronic gastric catarrh will require vegetable bitters and stomachics. If diarrhœa be present it should not be checked too rapidly. The pain may be relieved by mustard plasters to the painful parts. In later stages, where the degeneration of the hepatic cells is far advanced and ascites has set in, the patient's strength should be kept up and the state of the digestive organs improved as far as possible. The digestion should be promoted by vegetable bitters, mineral acids, pepsine, and nux vomica. The dropsy may sometimes be relieved by diuretics, purgatives, and tonics. Balsam of copaiba with spirit of juniper is highly beneficial in cases where the secretion of urine is scanty. It may be given in doses varying from ten to thirty minims. Dry cupping over the loins assists in relieving the lumbar pain. A course of tincture of iron combined with acetate of potash and purgatives will assist in removing ascites; mercurial alteratives may also be employed. Opiates are sometimes necessary to relieve the suffering. If there be profuse hæmorrhage astringents, as turpentine or ergot, will be serviceable. If dropsy be excessive and cause great distress, the fluid may be removed by tapping, but as a rule the operation should be delayed as long as possible. Any complications that may arise must be treated. Charcoal, small doses of hydrochloric acid, and various carminatives, as ginger, cardamoms, &c., will relieve flatulence and other stomach disorders.

equable climate is serviceable, and tonics, iron, and cod-liver oil are useful aids. Some recommend hydrochlorate of ammonia. Where syphilis exists any preparation of iodine does good. There is no special treatment for this complaint, but any existing cachexia should be combated. If the patient be strumous iodine does good. For marked anæmia iodide of iron is indicated.

PIGMENTATION OF THE LIVER.

Pigmentation of the liver is a *post-mortem* phenomenon noticed in a condition known as melanæmia. In this affection there is a deposit of granules of pigment of a brown or deep black colour in the blood, especially of the portal system. Some of the granules are free and isolated, others in irregular masses, and others again enclosed in cells. Their chief seat is in the portal blood, in the walls of the capillary network of the portal vein and the minutest branches of the hepatic artery; the pigmentation also spreads outside the vessels. The granules are scattered between the hepatic cells but not within them. In the early stage the pigmentation affects the periphery of the lobules; in advanced cases it extends to the centre and also attacks the hepatic venous system. The condition is often associated with malaria and enlarged pigmented spleen.

Symptoms.—The liver is generally increased in size at first, and subsequently becomes atrophied. As a consequence of pigmentation, the hepatic circulation is more or less impeded. There are symptoms of marked anæmia with occasional intestinal hæmorrhages, diarrhœa, and ascites. In advanced cases the kidneys become affected and there is albuminuria. Other symptoms are due to cerebral complications. Thus there may be delirium, coma, and paralysis. The disease is most often met with in the tropics.

The *treatment* is that of the symptoms and of the associated morbid conditions.

MORBID GROWTHS OF THE LIVER.

These may be divided into non-malignant and malignant growths. The non-malignant include (1) cysts, either simple or hydatid; (2) cavernous or erectile tumours; (3) tubercle; (4) syphilitic growths. The malignant diseases are cancer of the encephaloid, scirrhous, and colloid forms. Sarcomatous growths are occasionally met with.

Simple cysts vary in number and size; sometimes only one large one is present; when small, they are generally scattered throughout the organ. Their chief seat is the middle part of the anterior border decrease in size being in all directions. The surface is shrunken and flabby, and the capsule wrinkled or in folds and opaque. The tissue of the liver is soft and friable; the cut surface is dull yellow without any definite structure. The outlines of the lobules are destroyed, and the blood-vessels appear empty. The gall-bladder and bile ducts are empty, or contain only colourless mucus. Under the microscope, in the early stage, the hepatic cells are filled with granules; later on the cells are replaced by granular *débris*, oil-globules, and bile-pigment. Leucine and tyrosine abound in the hepatic substance, and if the organ be set aside for a time it becomes covered with crystals. The spleen is enlarged and soft. There is often extravasation of blood in the gastric and intestinal mucous membrane, and also in the peritoneum. The tubular glands of the stomach are filled with fatty degenerated epithelium. The kidneys are degenerated, and present pigment and fatty deposits in the epithelial cells; the muscular tissue of the heart is also degenerated.

Symptoms.—The disease often sets in with, or is preceded for some days or weeks by, jaundice. This is soon followed by coma, stertorous breathing, and dilated pupils. The disease sometimes sets in with irritability of temper, wandering, or low muttering delirium, and tremulousness of limbs; after a time the delirium becomes violent. There may be general or local convulsions, assuming an epileptic form. There is catarrh of the stomach and bowels, and the tongue is furred, and in advanced cases it becomes dry and brown and covered with sordes. There is nausea and complete loss of appetite. The pulse is at first normal, but soon after delirium has set in it rises to 120 or 130 in a minute; when coma supervenes it becomes very feeble, or even imperceptible. The temperature varies; it rises with the delirium.

In some cases the patient at first complains of pain in the hypochondrium and right shoulder. The pain is peculiar; it may be paroxysmal, and is increased by pressure over a limited part. The abdomen is tumid, and is also slightly tender. The natural hepatic dulness is much diminished; that of the spleen is increased. In a majority of cases there are no premonitory troubles, and jaundice is the first symptom to attract attention. In this disease there is a tendency to hæmorrhage in different parts and hæmatemesis, petechiæ, and ecchymotic spots over the body are common. There is often vomiting, and in severe cases the vomited matters are coffee coloured, owing to the action of the gastric juice on the blood. The skin is always yellow, but rarely of a deep colour; it is sometimes cool and dry, and there is total absence of fever. There is generally obstinate constipation, with pale, clay-coloured stools, which sub-

the size of a hempseed or larger. When cut open such masses are found to contain tuberculous pus. They may compress the smallest bile ducts, and lead to dilatation of the canals behind the compressed part. Under the microscope various giant or myeloid cells, pathognomonic of these growths, are met with.

Syphilis affects the liver in various ways, the most important of which is known as hepatitis gummosa. This occurs in the tertiary stage, or during the period of gummatous deposits. In another form of syphilitic disease the capsule and its prolongations are affected, the inflammation of the capsule being known as perihepatitis, that of its septa as parenchymatous hepatitis, or syphilitic cirrhosis. In some cases a small portion of the liver, in others a greater part, is affected. In gummatous hepatitis there are cheesy spots enclosed in dense hepatic tissue, with striæ extending from them in various directions. The liver surface is more or less adherent to the diaphragm. The two processes, viz. hyperplasia of connective tissue and development of gummata, are variously combined with each other. In the former the anatomical alterations in the liver resemble those found in cirrhosis. The surface is more or less grooved and indented, or becomes lobulated. At first the interlobular connective tissue is much increased, but as this growth contracts there is wasting of the parenchyma, and a cicatricial tissue is formed. The growth may be diffused or circumscribed. The diffused form is met with in children, rarely in adults. In advanced cases the liver is much deformed, and is of a dirty-grey colour. On section the liver substance is pale and firm, and traversed by lengthy bands of connective tissue. The secreting structure, the vessels, and the ducts are not much affected. Gummata or "encysted knotty tumours" consist of deposits in the substance of the liver. These growths often undergo fatty and other degenerative changes. They are of various sizes, and are rounded or irregular in form. They may be solitary or in groups, and may occupy any part of the liver, but are most common near the convex surface. They are more or less firm, and of a creamy yellow colour. The large deposits are soft and cheesy in the centre, and hard at the circumference, this being surrounded by a greyish-looking connective tissue, which is continuous with the healthy liver parenchyma. In their advanced stages they appear as stellate cicatricial depressions.

Syphilis is often associated with albuminoid degeneration or amyloid liver. The debility and cachexia dependent upon the syphilitic taint give rise to this degeneration. It is not to be attributed to the action of mercury, as was once supposed.

Symptoms.—These are generally obscure, both in the case of in-

a heated atmosphere aid considerably in the production of fatty liver.

Morbid appearances.—In the early stage there is a deposit of fat in the hepatic cells. At a later period the quantity of fat is increased, and the oil globules cluster round the nuclei in the cells, and the cells are also distended with fat. The deposit takes place at first in the periphery of the lobules. The liver is uniformly enlarged, but seldom to any great extent. Its specific gravity is diminished, so that a piece of it floats in water. Its margins are thick and rounded, the surface being quite smooth. It is pale yellow or of a drab colour. On section the cut surface presents a reticulated appearance, the tissue is soft, opaque, has a doughy, inelastic feel, pits on pressure, and readily breaks under the fingers. Very little blood escapes from the cut surface; the tissue is greasy, and fat may be detected on a knife, or fingers, or blotting-paper, or by ether. When a portion of it is held before a flame it burns after the water has been driven off. The fat consists of olein, margarine, and cholesterine. In limited cases fat granules, and oil globules are seen at the periphery of the lobules or in the outer zone in the vicinity of the portal vessels. In advanced cases the cells are filled with fatty granules or with a single large drop.

Symptoms.—Some are due to deranged functions of the liver, others are the result of fatty changes in other parts. In fatty infiltration dependent on indolent habits and luxurious living there is decided tendency to obesity, and fat is deposited in different organs, as well as in the omentum and subcutaneous cellular tissue. The patient shows a general want of tone. There is pallor and greasy or velvety condition of the skin, which is also flabby and loose. There is also a peculiar odour, due to abnormal oily secretion from the sebaceous follicles. In the early stage, when the hepatic cells are not much loaded with fat, there are scarcely any symptoms. When the disease begins to show itself there is more or less enlargement of the liver, chiefly in a downward direction. On palpation the liver is found to have a rounded border, and its consistence is diminished. The surface is regular. There is neither pain nor dropsy, and jaundice is rare. In marked cases there is a feeling of tension or uneasiness on lying on the left side. Enlargement of the spleen is rare. The skin often has a bloodless, semi-transparent appearance and a feeling of smoothness to the touch. In cases in which the liver is enlarged, and there is much abdominal fat, there is likely to be difficulty of breathing, especially after food. Various symptoms of dyspepsia, loss of appetite, constipation, and irregular action of the heart, are generally found associated with fatty disease of the liver.

pairment of general nutrition. Besides the progressive wasting the patient complains of a sense of discomfort or pain and a feeling of tenderness in the liver. The pain is sometimes excruciating and comes on in paroxysms; but it may be altogether absent. There is tenderness on pressure, especially when the peritoneum is inflamed. The pain shoots in various directions, to the spine or the sacrum, or to the angle of the scapula, sometimes radiating downwards to the lower part of the abdomen, and even to the extremities. If the liver be examined at this stage it is found sensitive to pressure and extending beyond its normal limits. As the case progresses the liver is found to be irregular in form and also considerably enlarged. The enlargement may be felt downwards, sometimes as low as the brim of the pelvis. Where the cancer is infiltrated the surface of the liver appears smooth. In the nodular form there is a tendency to rapid and progressive increase, and the outgrowths are hard and resisting. When the growths are few and small and occupy the posterior part of the liver, the form and size of the organ may not be altered. Jaundice occurs in nearly 50 per cent. of cases, and is due to compression of the hepatic ducts by the nodules, or by enlarged lymphatic glands in the portal fissures. Where the transverse fissure is considerably involved the jaundice is deep. When once established it seldom disappears. Ascites is present in half the number of cases, and is due to compression of the portal vessels or to peritonitis. The urine is either normal or more or less brown in colour. When jaundice exists the stools are pale in colour and the urine may be almost black. The spleen is seldom enlarged. The digestion is much deranged. There is loss of appetite, nausea, and in most cases vomiting is very troublesome. The bowels are constipated at first, afterwards the stools sometimes become dysenteric. Owing to pressure upon the lung there may be dyspnœa and severe cough. In advanced cases hæmorrhage frequently occurs from the stomach or bowels, and is sometimes associated with somnolence and delirium. There is also marked cancerous cachexia, and when there is no jaundice the face is sallow and anæmic. There is rapid wasting and loss of strength. Other symptoms are due to complications affecting the mammary glands, uterus, stomach, &c.

Diagnosis.—Cancer seldom occurs before forty. The existence of nodular swelling, its rapid growth, cancerous cachexia, and history of heredity, all point to cancer. Malignant disease may, however, occur in persons who have enjoyed unusually good health, and whose parents have lived to a great age. It may be mistaken for waxy liver, cirrhosis, hydatids, hepatic abscess, distended gall-bladder, large tumour of the right kidney, and cancer of the colon of a fawn-yellow colour, or pale red. When cut into a little pale blood oozes out from the cut veins. The spleen is generally, the kidneys are occasionally, enlarged. The application of a solution of iodine changes the colour to blood red, or brown, or walnut. Sulphuric acid gives a blue colour. Another test is a methyl-anilin violet. When this is applied the affected parts become violet red, the healthy structures assuming a violet-blue colour.

Symptoms.—The liver is slowly and uniformly increased in size, and appears as a visible prominent tumour. On palpation it is dense, firm, and resisting. The lower border is rounded and regular. Its form is not altered, and it is smooth on the surface. There is neither pain nor tenderness on pressure. In advanced cases there is a sense of fulness or tension. Dulness is increased upwards and downwards, and is more marked in front than behind. There is bulging in the right hypochondrium and in the epigastrium, but no bulging outwards of the ribs. The growth is slow and imperceptible, extending in some cases over many years. There are constitutional symptoms with œdema, and frequent evidences of a similar albuminoid disease in the kidneys, spleen, and stomach. The patient looks cachectic. The disorder is after some time followed by extreme emaciation, exhaustion and death. There is no tendency to obstruct the portal circulation, and hence there is no ascites, and no enlargement of the superficial veins of the abdomen. Ascites, if present in advanced cases, is due to kidney complication. Jaundice is also rare, but may occur from pressure of the enlarged lymphatic glands on the bile ducts or from catarrh of the ducts. The urine is usually of low specific gravity and contains albumen. The anæmia is well marked. The motions are of a pale yellow colour, and there is sometimes troublesome diarrhœa. In advanced cases vomiting is common.

Diagnosis. — The peculiar symptoms of this disease are the gradual progress and painless character of the enlargement. The spleen and kidneys are generally implicated, and there is always a pre-existing cachectic condition.

Prognosis.—It is favorable in the early stage. In advanced cases the kidneys become affected, and the prognosis is very unfavorable. The disease is generally chronic and lasts for years. Death takes place from general dropsy, intercurrent complications, or from general exhaustion.

Treatment. — The cause must be ascertained and dealt with as far as possible. The state of the general health must be improved, and attempts should be made to prevent the occurrence of complications. The diet ought to be nutritious, and such as can easily be digested. Wines and spirits are useful. Change of air to an

the size of a hempseed or larger. When cut open such masses are found to contain tuberculous pus. They may compress the smallest bile ducts, and lead to dilatation of the canals behind the compressed part. Under the microscope various giant or myeloid cells, pathognomonic of these growths, are met with.

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terstitial hepatitis and of gummatous growths. In some cases the liver is enlarged, in others it is reduced in size. Where the liver is enlarged the relative proportions of the right and left lobes are much altered. The surface of the liver is hard and sometimes covered with firm globular elevations. In advanced cases there is slight but slowly increasing ascites, with œdema of the lower limbs. There is seldom more than slight jaundice. The patient complains of pain and tenderness in the hepatic region, or of a sense of weight and uneasiness. Dyspeptic symptoms are constant. There are evidences of syphilitic cachexia, and in advanced cases obstinate diarrhœa.

The *treatment* is that of tertiary syphilis. Iodide of potassium is the main remedy.

Malignant diseases.—Carcinoma. In one in five of all cases of cancer the disease is seated in the liver. It may be either a primary affection, or secondary to cancer of the stomach or other abdominal organ. It sometimes supervenes after the extirpation of external cancerous tumours. These growths are characterised by (1) enlargement of the liver; (2) irregularity of the surface; (3) pain in the hepatic region; (4) jaundice; (5) ascites; (6) cancerous cachexia; (7) progressive emaciation; (8) rapidly fatal termination.

Anatomical appearances.—Cancer may occur as an infiltration of the liver tissue; large masses of the hepatic structure are uniformly affected, and the surface of the liver is regular. In other cases the cancer takes the form of circumscribed deposits, varying greatly in size, sometimes being as large as an orange. These masses may be either distinct or may coalesce. They cause considerable increase in the size of the liver, and when near the surface produce great irregularity. The masses on the surface sometimes present a central depression. The scirrhous growths are of the consistence of cartilage. Medullary cancer is the form most frequently met with. The colloid form is very rare, and appears only as a secondary deposit. Melanotic and round-celled sarcomata are rarely found in the liver. A few cases of epithelioma have been placed on record.

Symptoms.—They are generally insidious, and for some time, beyond the subjective symptoms, there is nothing to indicate hepatic mischief. In the early stage there may be gradual emaciation, debility with derangement of digestion, indicated by nausea, vomiting, furred tongue, and constipation. When the disease becomes established the symptoms resemble those of cirrhosis and other hepatic structural lesions. There are (1) pain, (2) alterations in the form and size of the liver, (3) those due to mechanical interference with the functions of the liver and other neighbouring organs, (4) im-

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Symptoms.—The commencement is insidious. The liver becomes gradually enlarged. There is a sensation of weight, and there may be slight pain due to pressure on neighbouring parts, or to the supervention of inflammation. The attention may be first excited by simple enlargement in the epigastrium or right hypochondrium. There is no disturbance of the functions of the liver, and neither fever nor deranged digestion. If hydatids also exist in the lungs there may be cough. In rare cases enlargement of the superficial veins of the abdomen, enlargement of the spleen, and signs of hepatic congestion are noticed. Ascites and œdema of the feet, when present, are due to pressure of the tumour on the trunk of the portal vein, or on the inferior vena cava, or on the iliac veins. Jaundice is rare, except when the tumour presses on the transverse fissure of the liver. Albuminuria may be present as a result of pressure on the veins, but the functions of the kidneys are rarely interfered with. When the tumour is very large it gives rise to a feeling of tightness or distension, and the pressure upwards causes cough, hurried breathing, and palpitation.

Physical signs.—The growth is slow, and may continue to progress for years. If the tumour be large it can easily be felt as an even, round, elastic or fluctuating mass, and the abdomen is considerably enlarged. The tumour is neither dense, hard, nor doughy. When situated behind the liver it will push the organ forwards, flatten it, and increase the area of hepatic dulness. In some cases, when the tumour is near the surface, it may be recognised by a peculiar thrill or vibration on percussion. When a little fluid is or stomach. The details of the diagnosis have been fully given in the chapter on enlargements of the liver. In waxy liver there will probably be albumen in the urine and history of cachexia or of protracted exhausting discharges. In cirrhosis the liver is generally contracted, nodulated, and tender. There is jaundice and ascites, but the history will aid the diagnosis. In the case of a hydatid tumour there is fremitus, fluctuation, and absence of serious symptoms.

Duration.—Death usually occurs within six months, but life may be prolonged to two years. Death is generally due to gradually increasing asthenia, or may be hastened by complications, as peritonitis.

Treatment.—The disease is incurable, and the treatment is only palliative. The pain may be relieved by poultices, with sedatives, as morphia internally, or by hypodermic injection. Tonics, and a nourishing diet with alcohol in some form, are the main remedies. Vomiting and other gastric disorders should be checked by bismuth, hydrocyanic acid, creasote, &c. Tapping is necessary only if the functions of the heart or lungs become affected.

Hydatid Disease of the Liver—Echinococci of the Liver.

A general description of hydatid disease has been already given (see page [illegible] of this volume). In nearly 50 per cent. of all the cases the liver is the part affected. In this organ the cysts are sometimes solitary, sometimes very numerous, and sometimes multilocular. They vary in size; some are very small, others as large as a man's fist; they are most commonly found in the right lobe, and they may be either deep-seated or superficial. When the cysts are small and deep-seated they cause no alteration in the size of the liver, but when large a tumour is formed, which may cause serious symptoms. The masses consist of cells filled with a gelatinous substance, and surrounded by a stroma of connective tissue. When this substance is examined with the microscope the characteristic membrane is found, generally dotted with opaque spots and granules, which are the scolices or heads of the future tæniæ. Circlets of hooks and single hooks are more or less abundant. In most cases suppurative and degenerative processes take place in the cysts, which then contain a dark or brownish-grey fluid, chalky masses, fatty globules, and crystals of cholesterine and of hæmatoidin. The pressure due to the cyst may cause atrophy of a portion of the liver, but sometimes hypertrophy is found. The bile ducts are sometimes obliterated; in other cases communications are formed between them and the cysts. Local thickenings and adhesions of the peritoneal coat of the organ are sometimes noticed. In their further course hydatids of the liver may burst either into the peritoneum, intestine, stomach, pleura, or lung. When they open into the peritoneum fatal peritonitis soon follows. They may also open into one of the bile ducts, and the entrance of bile into the cyst kills the parasites, and thus constitutes the beginning of a spontaneous cure. When the tumour grows rapidly it generally suppurates, but when its progress is slow the parent cyst often undergoes calcification, thus preventing further growth. There is death of the parasite, and ultimately a spontaneous cure is effected. In cases of recovery the outer covering of the cyst becomes firm and calcified and checks further growth; the hydatids which remain within the cyst compress each other, shrivel, and dry up, and even die. The fluid also becomes thick, and a putty-like *débris* with booklets of the worms remains behind. When the tumour dries up it often leaves a cicatrix-like depression.

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DISEASES OF THE SPLEEN.

The spleen occupies the left hypochondrium, and is situated near the cardiac extremity of the stomach, its convex surface being in contact with the diaphragm. It is of an oblong flattened form, of a dark colour, and very vascular. In structure it is a ductless gland like the thyroid, thymus, tonsils, and suprarenal bodies; it is made up of an elastic fibrous network, which forms the trabecular tissue, and the splenic pulp. The latter consists of blood-vessels and of Malpighian corpuscles. The spleen varies in weight in adults from four to ten ounces. In disease it may weigh from twenty to forty pounds; when much atrophied it has been known to weigh only half an ounce. It measures about five inches in length, three and a half inches in breadth, and one and a half in thickness. Its functions are connected with the work of sanguification through some chemical processes, which assist in various transformations of the albuminous elements of food. It is also associated with the metamorphosis of the blood-corpuscles. Moreover, it acts as a diverticulum for the accommodation of a large quantity of blood, an office for which its peculiar structure renders it specially adapted. After every meal the spleen is more or less congested. The spleen is subject to hyperæmia, or congestion; to inflammation, softening, suppuration, and rupture; to hypertrophy; to degeneration; to malignant, tuberculous, and syphilitic deposits; and to displacements.

Hyperæmia or congestion.—The anatomical structure of the spleen fits it for the accommodation of varying quantities of blood. One kind of congestion is a physiological process; another is pathological, and is due to a variety of causes. Pathological congestion may be either fluxional or obstructive. Fluxional congestion is observed in many acute infectious diseases, as typhus and typhoid fevers, in malarious fevers, and in pyæmia. It may occur during irregular menstruation, and as a result of injury and inflammation. Passive or obstructive congestion may be due to mechanical impediment to the portal circulation, as in cirrhosis of the liver; to venous obstruction, as in chronic lung or heart diseases; or to causes which interfere with the proper action of the liver. In slight cases the enlargement of the spleen appears and disappears very rapidly. When congestion is long continued, as in portal obstruction, or is often repeated, as in ague, the elasticity of the spleen is destroyed death by asphyxia; (*e*) adhesions with the alimentary organs may result in its discharge by the bowels or by vomiting; and with the abdominal parietes may cause an opening externally. These cases usually recover. 3. *Rupture:* The sac may burst from external injury, and the contents, escaping into the peritoneum, may set up fatal peritonitis.

Treatment.—So long as the growth does not give rise to any severe symptoms or interfere with any other organ it is best to leave it alone. Should the tumour rapidly increase and give rise to distressing symptoms, as pain and distension of the abdomen, or to dyspnœa and palpitation of the heart, tapping must be resorted to. The tumour should first be examined by an exploring needle, when, if it be an hydatid, a clear fluid, quite free from albumen, will escape. Certain precautions are necessary before tapping. A broad flannel bandage should be applied around the abdomen, commencing from below and carried up to the tumour; the cyst should not be completely emptied, as the risk of air entering it is thereby diminished. Adhesion of the cyst to the parietes can best be promoted by a compress and bandage over the wound. The after-treatment consists in perfect rest to the part, to ensure which a little opium may be given. It has been recommended not to use chloroform, because of its effects in setting up vomiting, and thereby preventing rest. It was formerly recommended not to puncture until the cyst had become adherent to the abdominal wall, but with a fine trocar the opening may be made in the absence of any adhesions, and without risk of escape of the contents into the peritoneum. When suppuration has taken place in the cyst a large trocar is necessary. Other methods of treatment recommended for hydatids of the liver are fraught with more or less danger. It has been advised to inject some stimulating fluid into the cyst after puncture; to make the opening by repeated applications of potassa fusa; and even to make a free incision by means of a bistoury, as is done in Iceland. But the simple operation as above described is to be preferred. Acupuncture, followed by the passage of a galvanic current through the cyst, has been tried with good effect. Various drugs, such as iodine, mercurials, and solution of common salt externally have been recommended on theoretical grounds, but are probably destitute of any efficacy.

DISEASES OF THE GALL-BLADDER AND GALL-DUCTS.

Diseases of the biliary passages include disorders of the hepatic duct and its biliary capillaries, of the cystic duct, and the common duct. They also include disorders of the gall-bladder, the principal of which are dilatation and biliary concretions or gall-stones. The bile passages or ducts are lined with mucous membrane, cylindrical epithelium, and racemose glands. The mucous membrane is frequently the seat of catarrh.

Catarrh of the bile ducts.—This is an inflammation of the biliary ducts and of the gall-bladder. The secretion of the mucous membrane is increased, and becomes viscid or muco-purulent. The lining membrane of the capillary ducts becomes thick and swollen with croupous exudation. In the early stage the canals are narrowed by the secretion and by the thickening of the membrane, and in this way a mechanical impediment is set up to the escape of bile. In advanced cases the canals become dilated. The narrowing most commonly affects the portion of the common duct embraced in the intestinal walls and its termination in the duodenum. The disease is generally temporary and subsides in a few weeks.

Causes.—The condition generally results from catarrh of the stomach and duodenum. In cirrhosis of the liver, in nutmeg liver, and in excessive hyperæmia, catarrh of the gall-ducts often results by extension. This catarrh is a common cause of jaundice in hyperæmia of the liver, whether simple or as a result of cancer, diseases of the lungs or heart, echinococci, &c. The chronic form of catarrh is set up by the presence of foreign bodies, as gall-stones and worms.

Symptoms.—The disease often sets in with jaundice, and the symptoms resemble those of gastro-intestinal catarrh, the most prominent being nausea, vomiting, loss of appetite, and furred tongue. In some cases there is diarrhœa at first. That there is catarrh of the duct may be inferred from these symptoms and from the absence of any physical signs of organic disease of the liver. In chronic cases, where the catarrh continues for months, the patients become emaciated, and dropsy of the bile passages may result. In such cases the gall-bladder appears as a tumour under the cartilage of the tenth rib on the right side.

Inflammation of the gall-ducts and gall-bladder also occurs in typhus and typhoid fever, and in typhoid states of the system due to other diseases. In the early stage the gall-ducts and gall-bladder contain croupous exudation, and in advanced cases become ulcerated, or suppuration takes place. The inflammatory exudation sometimes forms bands which obliterate the ducts. Inflammation of the ducts and the gall-bladder is known by pain and tenderness in the right hypochondrium and epigastrium. The liver is enlarged, the biliary passages dilated, and there is enlargement of the gall-bladder. Suppurative cases are known by chills or canal is completely obstructed, and the gall-bladder is either shrivelled up or dilated into a serous cyst; if in the common bile duct the outward flow of bile is obstructed, bile collects in the gall-bladder and in the hepatic ducts, and distends them. Sometimes biliary calculi cause adhesions between the gall-bladder and neighbouring parts, and lead to local abscesses with discharging sinuses following them.

Treatment.—It is unsatisfactory, inasmuch as the stones can neither be removed nor dissolved, and further growth cannot be arrested. We can only relieve the pain and other derangements, facilitate the onward movement of the stones, and endeavour to prevent the formation of fresh ones. To relieve the pain during their passage warm baths are very serviceable, and opium with belladonna internally, or morphia hypodermically, or inhalation of chloroform, will afford relief. Large linseed-meal poultices should be applied to the abdomen. Vomiting may be allayed by sucking ice. During the intervals between the attacks purgatives are generally indicated. Some recommend ether and turpentine, in the proportion of three parts of the former to two of the latter. Of this mixture twenty to thirty drops, enclosed in capsules, may be given three times a day. Carlsbad and other alkaline waters often act very beneficially in cases of gall-stones. The *modus operandi* of these remedies is uncertain. Some suppose that under their use a thin fluid bile is secreted in large quantities, and that the stones are thus washed out of the ducts. Others think that the alkaline constituents of these waters dissolve the cholesterine and other ingredients of the gall-stones. In all cases careful attention should be paid to the diet and to the functions of the skin. Fatty and starchy food should be taken in moderation, and stimulants should be interdicted. Exercise in the open air is always advisable.

form around them and open into them. Rupture of these abscesses or of the ducts themselves may set up fatal peritonitis.

In health, the gall-bladder cannot be felt during life; but when distended, as a result of obstruction, it can often be detected on palpation. The gall-bladder may also be felt when its walls become fibrous or calcified, or the seat of cancer, or its cavity contains numerous calculi. A tumour may then be detected in the region of the gall-bladder, below the border of the right lobe of the liver. When full of fluid it appears as a rounded, pyriform, or sometimes oblong tumour. The liver is enlarged at first, and the dilated gall-ducts may resemble cysts filled with bile. Atrophy of the liver occurs in long-continued cases. In so-called dropsy of the gall-bladder, the receptacle becomes converted into a translucent cyst which may attain the size of a child's head. It has been mistaken for ascites, and tapped.

Symptoms —As a result of obstruction there is intense jaundice and absence of bile from the fæces. At first the liver is uniformly enlarged, and there is therefore increase of hepatic dulness. The accumulation of bile and other secretions distends the gall-bladder, which can be felt as a fluctuating tumour in the hepatic region, at the edge of the right lobe. At a later stage the liver is atrophied, or there is general shrinking of the organ. The urine is high coloured, and is found to contain bile acids and also bile pigments. In advanced cases the retention of bile acids gives rise to yellow vision, itching, eruption on the skin, and hæmorrhages from the stomach and intestines. Notwithstanding the severity of the symptoms there is no rise of temperature.

Terminations.—These vary with the cause. Death may occur from perforation of the gall-bladder or of the ducts, leading to peritonitis. There is sometimes inflammation of the ducts, ending in suppuration. Where adhesions are formed between the ducts or the gall-bladder and the neighbouring parts biliary fistula may result, the opening taking place externally or into the stomach, colon, or duodenum.

Treatment.—The cause of dilatation and enlargement should be discovered and, if practicable, removed. Catarrh of the ducts may be relieved by half-drachm doses of ipecacuanha, followed by mustard footbaths. The obstruction by gall-stones may sometimes be relieved by sedatives internally, and locally applied, and antispasmodics are often given with benefit. The remainder of the treatment is mainly hygienic. The bowels should be regulated. If constipation exists laxatives should be given, while the functions of the skin and kidneys should be promoted by appropriate measures.

Gall-stones—Hepatic calculi.—These are formations or concretions consisting of bile pigments, particles of mucus, lime salts, cholesterine, and casts of the hepatic ducts. Their surface is generally smooth; they vary in size from that of a hempseed to that of a hen's egg, and in weight from fifteen grains to twenty drachms. They may be solitary or multiple. When solitary the concretion is generally large and round or oval in shape; when numerous they are small and wedge-shaped, and accurately fitted to one another. They are formed by the deposit of solid matter around a nucleus, which may be a clot of blood or merely epithelium lining the duct, or a cast of the duct itself. Their chief seat is the gall-bladder and the cystic and common ducts. Those in the gall-bladder are generally black or brown and globular or pear-shaped. They may be soft and friable or hard; they are generally greasy to the feel as they contain a large amount of cholesterine. In the branches of the hepatic duct they are small, rough, of a dark colour, and often branched. If developed in a bile duct, they are moulded to its shape. When fresh their specific gravity is high, but when dried they float in water. When raised to the temperature of the body they lose their hardness, and can be moulded by the fingers. The black variety when cut presents a white nucleus, generally with concentric laminæ and an outer crust. The nucleus is often found to consist of casts of biliary ducts, rarely of ascarides or any other foreign body.

Causes.—The disease is rare before forty, and is more common in females than in males, owing perhaps to their sedentary habits. Persons who indulge too freely in food and drink, or who, like many classes in India, take one huge meal daily, are liable to suffer. Those of a gouty diathesis are also prone to be attacked. In cases of cancer of the liver gall-stones are common, while in cirrhosis they are very rare. Their formation is said to be due to the decomposition of bile acids, which is prone to occur where there is retention of bile in the gall-bladder. It has been found that cholesterine is precipitated when the reaction of bile is changed from alkaline to acid. The retention of bile in the gall-bladder or gall-ducts facilitates the growth of these concretions. Spontaneous solution and breaking up of gall-stones probably occurs when improvement takes place in the condition of the bile.

Symptoms.—Biliary calculi are often found in the gall-bladder after death in patients who exhibited no symptoms of liver disease during life. It is after they leave the gall-bladder and during their passage along the cystic and common ducts into the intestines that they give rise to symptoms of gall-stone colic. These may begin with dull pain in the hepatic region, febrile phenomena, nausea, and vomiting. Obstruction in the hepatic duct causes pain, fever, jaundice, and vomiting; when gall-stones exist in the cystic duct or in the gall-bladder there will be no jaundice. In occlusion of the common duct jaundice is always present. In a majority of cases, the passage of gall-stones along the cystic or common duct is accompanied by sudden and severe paroxysmal shooting or stabbing pain, with tenderness in the epigastrium. The pain extends to the back or the right shoulder, and sometimes to the extremities. It may be so severe as to cause delirium or convulsions, and hysterical symptoms in women. Sometimes pressure over the abdomen gives relief. There is high fever with nausea and vomiting. The vomited matters consist of half-digested food at first; and afterwards of watery mucus. The bowels are constipated, and there is much flatulence. In some persons stones in the gall-bladder can be felt on palpation. There is pain and tenderness in the right hypochondrium and the epigastrium. In a few hours after the attack the skin may appear slightly jaundiced, and the conjunctivæ look yellowish. The stools are clay-coloured, owing to the impediment to the escape of bile into the intestine. In many cases the calculi recede into the gall-bladder and immediate relief is procured. The long impaction of a stone in the cystic duct leads to dropsy of the bladder, and sometimes to ulceration and perforation of the duct. As a general rule, however, the symptoms subside after the lapse of several hours or days. Partial relief is obtained, but the pain returns when the stone reaches the duodenal orifice. When the calculus has passed into the bowels, complete relief follows; the stools become black, and the jaundice begins to disappear. The gall-stones are often found evacuated in the fæces. In rare cases the stone may obstruct the intestine and cause death. In ordinary cases in which recovery has taken place the patient is subject to repeated attacks of the same kind, and often becomes anæmic and exhausted.

Terminations.—Gall-stone colic often ceases suddenly, either from the slipping back of the stone into the gall-bladder, or, as in favorable cases, from the passage of the stone into the duodenum, in which case the calculi are found in the stools. In every case where the spasm or the colic is relieved the fæces should always be examined for the stone. When the calculus is not found in the fæces it is probably lodged in some portion of the small intestine. In some cases in which calculi remain in the gall-bladder the irritation leads to catarrhal inflammation of the mucous membrane, and this may run on to suppuration and ulceration. The abscess may burst through the abdominal walls, or may open into the intestines, stomach, or lungs. If stones are formed in the hepatic duct the canal is completely obstructed, and the gall-bladder is either shrivelled up or dilated into a serous cyst; if in the common bile duct the outward flow of bile is obstructed, bile collects in the gall-bladder and in the hepatic ducts, and distends them. Sometimes biliary calculi cause adhesions between the gall-bladder and neighbouring parts, and lead to local abscesses with discharging sinuses following them.

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The spleen occupies the left hypochondrium, and is situated near the cardiac extremity of the stomach, its convex surface being in contact with the diaphragm. It is of an oblong flattened form, of a dark colour, and very vascular. In structure it is a ductless gland like the thyroid, thymus, tonsils, and suprarenal bodies; it is made up of an elastic fibrous network, which forms the trabecular tissue, and the splenic pulp. The latter consists of blood-vessels and of Malpighian corpuscles. The spleen varies in weight in adults from four to ten ounces. In disease it may weigh from twenty to forty pounds; when much atrophied it has been known to weigh only half an ounce. It measures about five inches in length, three and a half inches in breadth, and one and a half in thickness. Its functions are connected with the work of sanguification through some chemical processes, which assist in various transformations of the albuminous elements of food. It is also associated with the metamorphosis of the blood-corpuscles. Moreover, it acts as a diverticulum for the accommodation of a large quantity of blood, an office for which its peculiar structure renders it specially adapted. After every meal the spleen is more or less congested. The spleen is subject to hyperæmia, or congestion; to inflammation, softening, suppuration, and rupture; to hypertrophy; to degeneration; to malignant, tuberculous, and syphilitic deposits; and to displacements.

Hyperæmia or congestion.—The anatomical structure of the spleen fits it for the accommodation of varying quantities of blood. One kind of congestion is a physiological process; another is pathological, and is due to a variety of causes. Pathological congestion may be either fluxional or obstructive. Fluxional congestion is observed in many acute infectious diseases, as typhus and typhoid fevers, in malarious fevers, and in pyæmia. It may occur during irregular menstruation, and as a result of injury and inflammation. Passive or obstructive congestion may be due to mechanical impediment to the portal circulation, as in cirrhosis of the liver; to venous obstruction, as in chronic lung or heart diseases; or to causes which interfere with the proper action of the liver. In slight cases the enlargement of the spleen appears and disappears very rapidly. When congestion is long continued, as in portal obstruction, or is often repeated, as in ague, the elasticity of the spleen is destroyed and hence either enlargement with softening, or a permanent state of induration of the organ frequently results. Congestion is common in children suffering from tubercular or congenital syphilitic cachexia, and in anæmia and leucocythemia the enlargement is often marked. In rickets there is a peculiar morbid deposit in the spleen, and the organ is often enlarged.

Post-mortem appearances.—The spleen is much enlarged, owing to distension of the vessels and to accumulation of blood in the vascular passages. The capsule is stretched, thickened, and smooth. The spleen is often five or six times its normal weight. It is of a dark colour, often pulpy, of diminished consistence, and is easily lacerable.

Symptoms.—In the normal state its lowest point is close to the anterior extremity of the eleventh rib. In states of congestion a tumour is formed in the left hypochondrium, presenting an external smooth and convex surface. It rises into the chest, and also extends downwards and inwards across the abdomen. The tumour is readily moveable under the fingers, and is depressed by the diaphragm during deep inspiration. On its anterior edge there are often notches, which are very characteristic. The patient complains of a sense of fulness, tension, and occasionally more or less pain and tenderness in or about the left hypochondrium, and exhibits appearances known as splenic cachexia. This condition is characterised by a peculiar sallow aspect, dingy discolouration of the skin, anæmic appearance of the gums, weakness, general wasting, and dyspnœa. Such patients are liable to hæmorrhages from various tissues of the body; they often suffer from derangements of the stomach and bowels, and exhibit a tendency to sloughing sores from slight causes. In long-continued cases there is often some amount of abdominal dropsy.

Splenitis—Acute inflammation of the spleen.—As a primary affection the disease is rare. Blows or violence may cause splenitis, but are more likely to produce rupture of the organ, especially if it be enlarged. Inflammation of the spleen is generally due to the occurrence of hæmorrhagic infarctions which eventually lead to suppuration. In valvular diseases of the heart the vegetations of fibrin which form on the valves often lead to embolism. During the course of contagious fevers and in pyæmia, splenitis due to infarction sometimes occurs. In splenitis the infarctions, especially in pyæmic cases, may end in splenic abscesses. These have been known to open externally, and they sometimes become connected with the neighbouring organs, as the left lobe of the liver, diaphragm, omentum, colon, stomach, and cavity of the peritoneum and even the thoracic viscera. Splenitis may also end by the infarction undergoing caseation or becoming converted into fibro-cellular substance which may afterwards become cretaceous. These infarctions correspond to the area of distribution of the terminal branches of the splenic arteries.

Secondary splenitis may be due to pyæmia or blood-poisoning. The infarctions readily suppurate and set up inflammation of the capsule. In pyæmia the blood in the splenic vessels readily coagulates, and these infarcts are formed in the absence of any embolic process.

Post-mortem appearances.—The spleen is enlarged by fluxionary hyperæmia due to the infarctions. It is brownish red and hard, or very dark and soft. Where infarctions exist they may be about a cubic inch or two in size. In the centre they are generally rounded, but towards the surface they form numerous dark wedge-shaped masses, with the base towards the surface. The infarctions, at first dark brown and hard, afterwards assume a yellowish, then a buff, and at last a white colour. Pus may form, causing one or more abscesses; in a few cases the spleen has been found full of pus. These abscesses may open in various directions as already mentioned.

Symptoms.—The general symptoms are those of splenic cachexia. The patient is anæmic and emaciated. The presence of the infarctions, hyperæmia, and inflammation gives rise to swelling of the whole gland. When splenitis is due to valvular disease of the heart, the infarcts are generally numerous and the enlargement is therefore very great, and the tumour is painful and tender. There is often ascites and dropsy, and such cases generally end in abscess. The enlargement occupies the left hypochondrium; it may extend low down even as far as the pelvis, may be felt forward beyond the right side of the *linea alba*, and backwards towards the spine. Its anterior border is lobulated and notched and can be felt by the fingers. The tumour is freely moveable when handled and on deep inspiration, coughing, and change of posture. In splenic abscess the patient complains of pain in the left hypochondrium and in the left shoulder. The temperature ranges between 99° and 103°. The gums and lips are anæmic; the tongue tremulous, the appetite bad, and there is great thirst. The pain is generally due to local peritonitis, and is increased by the respiratory movements. Examination of the heart may reveal a systolic murmur. When a large abscess exists, there is a fluctuating tumour in the splenic region, accompanied by sympathetic vomiting, rigors, hectic fever, and rapid wasting. If the abscess opens into the lung, the patient suffers from rigors and has a cough, which is dry at first, but soon becomes loose and attended with muco-purulent expectoration, tinged with blood. Perforation in the peritoneum will set up inflammation, either diffuse or circumscribed. If the abscess burst into the stomach or colon, the pus will be discharged either by vomiting or from the bowels.

Diagnosis.—The enlarged spleen, as the result of splenitis, may be mistaken for (1) lardaceous disease; (2) malignant tumours of the spleen or the cardiac end of the stomach; (3) swollen left lobe of the liver; (4) omental or suprarenal growth; (5) enlarged spleen, as occurs in Hodgkin's disease; (6) leucocythemia or simple hypertrophy of the spleen. Lardaceous disease always affects, besides the spleen, the liver, kidneys, and even the intestinal villi. The Malpighian bodies or sacculi look like grains of sago. This condition occurs in protracted cases, and is especially associated with scrofula, syphilis and chronic bone diseases. Cancer is rare as a primary disease. It generally follows cancer of the stomach or other organ. There is cancerous cachexia, pain in the tumour, and irregular nodulated condition of the surface. In splenitis the duration is less than that of hypertrophy from congestion. The sudden appearance of enlargement and sudden pain point to infarction. In hypertrophy the enlargement is general and uniform, and not circumscribed.

Treatment.—As the disease is generally due to infarction, all sources of mechanical congestion should be dealt with as far as practicable. Thus, constipation may be removed by a brisk saline purgative or by compound jalap powder. The pain and tenderness may require the hypodermic injection of morphia for their relief. A blister over the left infrascapular region will also be serviceable. The temperature may be reduced by salines, or by salicylates, or by cold sponging assiduously applied. If the patient be sthenic, leeches to the left hypochondrium will do good; ordinarily, poppy fomentations and turpentine stupes, and, when the abscess is beginning to form, large linseed poultices to the splenic region are required. During suppuration the patient should be well supported, and carbonate of ammonia with cinchona given from time to time. The abscess may be treated as recommended for hepatic abscess.

Hypertrophy of the spleen.—True hypertrophy, without any abnormality, either in the spleen or in the blood, is very rare. Enlargement due to congestion occurs in specific fevers, chiefly in malarial and enteric fevers, erysipelas, puerperal fever, pyæmia, and acute tuberculosis. Repeated and long-continued congestion is often associated with portal obstruction, and hence enlargement is found in cirrhosis of the liver. Very considerable hypertrophy is witnessed in persons who during many months or years have suffered from repeated attacks of tertian or quartan ague. This enlargement is known as ague-cake. It also occurs in persons living in malarious districts, but not exhibiting distinct attacks of fever. Enlargement of the spleen is found in connection with syphilitic cachexia, in rickets, in leucocythemia, and in Hodgkin's disease.

Post-mortem appearances.—The largest spleens are found in cases of leucocythemia. There is true hypertrophy of the organ in all its parts. It is increased both in size and weight, and has a firm consistence. On section its substance may be quite natural; sometimes it is pale and dry, and presents a peculiar, smooth, lustrous appearance. Lymphatic structures are also found in its substance. These are composed of adenoid tissue, and resemble the Malpighian bodies or splenic corpuscles. The liver is also enlarged and pale.

Symptoms.—The symptoms are those of splenic cachexia associated with the physical signs of splenic tumour. There is a feeling of weight and fulness in the abdomen, and more or less pain from time to time. Ascites and anasarca are often present. The surface of the body is pale and sometimes slightly jaundiced. There is a swelling on the left side of the abdomen, somewhat painful, and often extending from the upper margin of the seventh rib downwards to the iliac region, and in front to some distance beyond the umbilicus. In marked cases it measures as many as eight or nine inches vertically, and about six or seven inches transversely. The patient often complains of headache and giddiness. The appetite is impaired, the tongue is furred and moist, the bowels are irregular, and the urine is scanty and high coloured. Hæmorrhage from the nose and gums often takes place. The duration is much prolonged. When death takes place it is from anæmia or from hæmorrhage, or from complications, as diarrhœa.

Treatment.—When enlargement is the result of congestion, as due to ague, quinine and arsenic are the main remedies, and purgatives should also be given from time to time. Small doses of strychnia and bromide and iodide of potassium are often successful in such cases. Depletion and mercury internally are most injurious. The health must be improved by attention to diet and hygiene. For reducing the size of the splenic enlargement, when not otherwise complicated, it is recommended to give phosphorus internally, and to apply locally the ointment of the biniodide of mercury or the tincture of iodine. In recent cases a cold douche over the splenic region or the ether-spray may be used with advantage. Faradisation over the spleen causes contraction of the organ, and has been employed with advantage in some cases.

DISEASES OF THE PANCREAS.

The pancreas is an organ of great use in the economy; its disorders are extremely rare, and seldom exist independently. Its secretion subserves three different purposes in the process of digestion: (1) it is an important agent in the emulsification of fat; (2) it promotes the conversion of starch into dextrine and sugar; and (3) the conversion of albuminoids into products fit for digestion. The retention of the fluid in the blood interferes with general nutrition, and much fat appears in the alvine discharges.

The general symptoms of disorders of the pancreas are due, not so much to the implication of the organ itself, but rather to its effects upon other structures with which it is closely related; to their participation in the morbid condition, or to the intimate vascular and nervous connections between this and other organs. These symptoms will first be described in a general manner.

1. *Subjective sensations.*—These when present are deep seated in the abdomen, a little above the umbilicus and occupying the region of the pancreas. They are often absent even though the organ is considerably diseased. These morbid sensations consist of pain, a sense of uneasiness, weight, or oppression. The pain or uneasiness may be due to the effects upon the surrounding structures, or to irritation of the peritoneum. There may be a sensation of dragging, especially when the organ is enlarged, the sensation being more felt in the erect than in the recumbent posture. The pain is said to be due also to implication of the solar plexus, and its ganglia. In inflammation of the pancreas the pain is of an acute or violent character and accompanied by extreme tenderness. There is also a feeling of great restlessness with a tendency to faintness or actual syncope.

2. *The secretion is disordered.*—The alteration may affect the quantity or the quality of the secretion. When the quantity is great, the fluid enters the stomach and gives rise to pyrosis and is discharged by the mouth. The excess of pancreatic secretion has been supposed to cause a form of chronic diarrhœa. The secretion may be diminished in quantity or may be absent altogether. In such cases the fat is not digested or absorbed, and there are symptoms of intestinal indigestion and constipation. The patient passes a quantity of free fat or oily matter in the stools. The fat may come away like oil with scarcely any fæcal matter, or the oil

may float on the surface of liquid fæces. Sometimes the stools consist of white or pale yellow and tallow-like lumps. It has been observed that in pancreatic diseases the amount of fat discharged is sometimes greater than the quantity consumed. In such cases the excess of fat is obtained by absorption from the general system.

3. *Jaundice* is a frequent symptom in diseases of the pancreas, and is due to obstruction of the bile duct.

4. *Deranged digestion.*—Obstruction of the pylorus or of the duodenum is likely to result from disease of the pancreas, and give rise to chronic and obstinate vomiting, often associated with signs of dilatation of the stomach. The pressure of the pancreas on the stomach may lead to gastric ulcers, and even to perforation and hæmatemesis. The portal, the mesenteric, and even the splenic veins are liable to be pressed upon, or closed by thrombosis, and hence ascites, intestinal hæmorrhages, and enlargements of the spleen may be present. Pressure on the aorta may cause a pulsation or a murmur heard through the pancreas and simulating an aneurysm.

5. *The general symptoms* in diseases of the pancreas are debility, marked anæmia, and emaciation. These symptoms are also found in Addison's disease, in cases of absence of bile from the intestine, and also in diseases which interfere with the passage of food through the pylorus or along the duodenum. It follows therefore that there is nothing specially distinctive about them. Lowness of spirits and great despondency are generally present.

6. *Urine.*—In some cases of pancreatic disease the urine contains oil globules or fat. This is supposed to be due to the absorption of fat in the process of wasting. It has been observed that chronic inflammation of the pancreas, atrophy, fatty degeneration, dilatation of the duct, are sometimes associated with diabetes, which may either precede or follow the pancreatic disease. Diabetes in such cases probably depends upon implication of the solar and cœliac plexuses and semilunar ganglia.

Physical signs.—These are very few in number. When the head of the pancreas is enlarged, a deeply-seated tumour may sometimes be detected. The patient should be placed on his elbows and knees, and pressure should be made from before backwards, and from side to side. Owing, however, to the position of the organ a positive diagnosis is scarcely possible.

The pancreas is subject to hyperæmia or congestion and inflammation, ending in induration, chronic inflammation, or abscess. It is also subject to various degenerations and morbid growths, such as syphilitic gummata, carcinomata, cystic growths, also to calculi and to dilatation and obstruction of the ducts.

Acute inflammation.—As a primary affection it might be caused by injury over the pit of the stomach. As a secondary disorder it has been known to arise in various acute fevers, as typhoid and acute tuberculosis; also in pyæmia and septicæmia.

Anatomical appearances.—Various changes are observed. The organ appears hyperæmic and enlarged, and firm in consistence. This condition may exist for a time and terminate in resolution. In other cases suppuration sets in, either in the form of purulent infiltration or as small abscesses. Small hæmorrhages into the cellular tissue often occur. The inflammation sometimes assumes a parenchymatous form, and leads to degenerations.

Symptoms.—These are often quite obscure. The first symptom which might lead to the suspicion of inflammation is a deep-seated violent paroxysmal pain in the epigastrium, accompanied by extreme tenderness. There is also gastric derangement with febrile phenomena. In mild cases recovery follows, but in other cases the pain speedily increases and becomes constant, and may shoot upwards to the shoulder and laterally towards the back. The gastric disorder is increased, and there is vomiting of a viscid fluid containing bile. There is great thirst, and the bowels are constipated. The pulse is weak. There is great restlessness, with hurried breathing and a tendency to syncope. Death is preceded by collapse.

Treatment.—The disease is seldom recognised during life. The most prominent symptoms should be attended to. The patient must be kept at rest, and the pain and vomiting relieved by ice, and morphia, either by the mouth or hypodermically injected. Cupping or a few leeches should be applied to the epigastrium, and followed by warm fomentations. Stimulants are indicated if symptoms of collapse appear. If constipation is present a few grains of calomel would probably be the best remedy.

Chronic diseases of the pancreas.—These include (1) chronic congestion or those conditions connected with derangements of circulation. Thus in obstacles to the portal circulation, as in diseases of the heart, lungs, or liver, the pancreas becomes congested. Hæmorrhages sometimes take place into the pancreas, the blood subsequently undergoing changes ending in pigment deposit. Apoplectic cysts may occur in the pancreas as a result of rupture of a vessel. The organ also participates in the want of blood in the system generally, as occurs in anæmia.

2. **Hypertrophy.**—This condition is rare, but has been observed in persons suffering from diabetes, in which the organ is sometimes increased in size and weight.

3. **Atrophy.**—This is of common occurrence in old age and in

cases of general wasting from any cause. In diabetes atrophy is sometimes extreme. It may also result from pressure upon the gland by morbid growths in its vicinity, or from diseases of the organ itself. Atrophy is generally associated with fatty degeneration.

4. **Fibroid or cirrhotic** changes in the pancreas. These may involve either the whole of the organ or some portion of it, the head of the pancreas being most often affected. The changes are the same as those which occur in the early stage of cirrhosis of the liver; they lead to induration of the organ, which becomes firm, tough, and granular, and also irregular in shape. The causes which give rise to this condition are prolonged venous congestion, chronic alcoholism, retention of the pancreatic fluid with dilatation of the ducts, cancer, and syphilitic growths.

5. **Chronic suppuration.**—This condition is sometimes due to the existence of calculi or formation of cysts. In scrofulous subjects and in tubercular disease caseous degenerations may follow chronic inflammation. In chronic suppuration the abscesses may burst into the abdominal cavity or other parts, or the pus may dry up and undergo calcareous changes.

6. **Degenerations.**—Those affecting the pancreas are of two principal kinds: fatty infiltration and fatty metamorphosis. The fatty infiltration is associated with obesity. It affects the interstices of the connective tissue, and ultimately causes wasting of the organ by pressure. The fatty metamorphosis affects the gland cells, and is of common occurrence in chronic alcoholism, in diabetes, and in other wasting diseases. The organ becomes small, soft, and flaccid, and may even be destroyed.

7. **Morbid growths.**—Cancer of the scirrhous variety is the most common, the other forms being very rare indeed. It is seldom primary, and is generally due to extension of the disease from the pyloric end of the stomach or the duodenum. Cancer of the pancreas is more common in men than in women, and is rare under forty years of age. It generally affects the head of the organ, which then presents hard, irregular, nodulated elevations, which are whitish on section. The unaffected portions are atrophied, and the ducts are dilated, and often contain calculi. The disease has a tendency to extend to the neighbouring structures, and thus the stomach, duodenum, peritoneum, &c., are involved in the process of destruction and ulceration. In some cases it extends to the vertebræ, and leads to their destruction. Other morbid growths, as sarcoma, tubercle, and syphilitic gummata are extremely rare in the pancreas.

8. **Obstruction and dilatation** of the ducts and cystic **formations.**

Obstruction may be due to conditions outside the gland causing pressure, as tumours, enlarged glands, and gall-stones; to thickening of the duct or adhesions due to inflammation; to conditions in the gland or the duct itself, as chronic inflammation, or catarrh of the duct; malformation or bending of the duct, calculi, and malignant or other growths. Whatever the cause, the duct behind the obstruction becomes dilated owing to the accumulation or retention of secretion within it. The principal duct may become large enough to admit a finger, the dilatation being either uniform or irregular. The branches of the duct also become dilated, and ultimately one or more cysts are developed, and the pancreas appears as if made up of a congeries of cysts. These are filled with various materials, such as pancreatic fluid, serum, pus, blood, and caseous matter. The walls of the cysts are thick and indurated, and when many in number the organ may be completely destroyed. Cystic formations are sometimes found associated with diabetes.

9. **Calculi.**—These are sometimes found affecting the main duct or its divisions. They vary in number from one to many, and in size they may be very minute or as large as a nut. They may be white or darkish or even black, and oval or round, and either smooth or rough on their surface. Chemically examined they are found to consist of the carbonate and phosphate of lime. They originate from the pancreatic juice, the inorganic constituents of which if retained are apt to be precipitated, and this process is materially aided by catarrh of the ducts. The results of the calculi are dilatation of the ducts and production of cysts; inflammation and abscess; chronic inflammation and degenerations. They may also escape through the main duct.

Symptoms. — As already remarked, diseases of the pancreas present very few symptoms, the morbid conditions not being recognised during life, but discovered only on post-mortem examination. In a majority of cases, its lesions are associated with morbid conditions of other structures, so that the symptoms present cannot with propriety be assigned to the pancreas alone. Many of the chronic diseases of the pancreas give rise to morbid changes in the formation and escape of its secretion, and to symptoms more or less significant either of excess or deficiency of the pancreatic juice in the stools. Other symptoms are more directly connected with its morbid conditions. Thus in chronic inflammation, there is paroxysmal and deep-seated pain in the epigastrium, accompanied with tenderness. Pressure on the neighbouring organs or structures may lead to jaundice, ascites, or symptoms of obstruction of the pylorus or duodenum. General wasting or even diabetes might also be present.

In cases of cancer, the patient gradually wastes, and there is weakness and marked depression. On physical examination the diseased organ may possibly be felt as a hard, nodulated, firm, and resisting body. The ordinary symptoms are, pain, which is deep seated, very severe, and felt in the epigastrium. Sometimes there is no pain throughout the whole course of the disease, or it may come on only at a late period. It is but little relieved by medicines. Its character varies in different cases; exacerbations are common and severe, and it may be influenced by food, movements, and posture. Other symptoms are gastric derangements, such as nausea, vomiting, eructations, and often abundant watery pyrosis. The tongue is clean and moist. The bowels are generally constipated, and the evacuations contain fatty matter. Thirst is a marked symptom, and pressure on the neighbouring structures sometimes leads to jaundice.

Cysts may attain such a size as to form deep-seated, rounded tumours, smooth, soft, and fluctuating. In the case of calculi, the symptoms are those due to the mechanical effects upon the organ, and obstruction of the ducts.

Diagnosis.—The diagnosis of diseases of the pancreas is extremely difficult and sometimes impossible. Cancer is the least difficult to be recognised. Lesions of the pancreas are often confounded with diseases of the liver or stomach, and the diagnosis can be made only *per viam exclusionis*. The pain in cancer of the pancreas may easily be referred to gall-stones, especially if jaundice be present. Even if a tumour can be felt, it must always be difficult to exclude diseases of the pylorus and duodenum from consideration. A pancreatic tumour may pulsate, and thus simulate aneurysm of the aorta. In all cases of suspected pancreatic disease the abdomen must be carefully and repeatedly examined.

Prognosis.—In the case of cancer, its duration is about a year, and death is inevitable. In other diseases the prognosis is for the most part unfavorable.

Treatment.—In suspected chronic diseases of the pancreas, treatment is of little avail, though various plans have been recommended. These include regulation of the bowels by the use of saline purgatives and mineral waters in order to relieve congestion of the portal system. Calomel is thought to have a specific action on the pancreas, and may be given occasionally. Where syphilis is suspected iodide of potassium is especially indicated. In all cases the most prominent symptoms should be attended to.

The pain may be relieved by opiates, either given by the mouth or subcutaneously injected. Sweetbreads should be used as an article of diet, and various preparations as pancreatic emulsion, or liquor pancreaticus might be given. Ether is credited with the power of exciting the secretion of the pancreas and promoting the absorption of fatty matters. In order to improve the digestion various bitter tonics should be tried.

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